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A MANUAL

FOR THE

COUNTY HIGH SCHOOLS OF ALABAMA

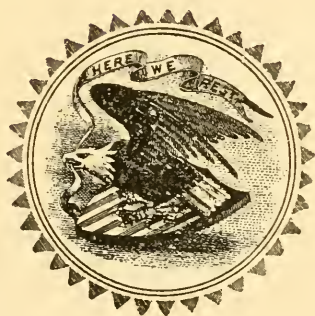
WITH

RULES AND REGULATIONS
COURSE OF STUDY AND
LIST *of* TEXT BOOKS



ISSUED BY
THE DEPARTMENT OF EDUCATION
MONTGOMERY, ALA.

A MANUAL
FOR THE
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OF ALABAMA



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Montgomery, Alabama
The Brown Printing Co., State Printers and Binders
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INTRODUCTION.

TO THE TEACHERS OF THE COUNTY HIGH SCHOOLS

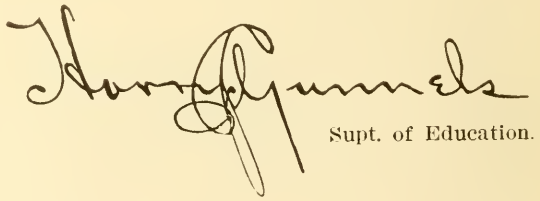
This Manual is issued by the Department of Education for the guidance of the County High School principals and teachers of Alabama. It is hoped also that other high school teachers will find it to be of real service to them in their work. The need for such a publication has been keenly felt for several years, and no doubt the sending forth of this little book will mark a step forward in securing that uniformity of educational practice which is so much to be desired in all the secondary schools of the state.

The topics included in the Manual are the rules and regulations formulated by the High School Commission; the prescribed course of study, together with the text-books to be used; and specially prepared syllabi of the subjects embraced in the course of study. These syllabi were prepared by various professors in the University of Alabama and the Alabama Polytechnic Institute, to whom the Department of Education is under lasting obligations for this work gratuitously done for the state.

The County High School principals and teachers should study the rules and regulations carefully and follow them closely. The course of study, which is slightly different from the one in force last year, must be strictly followed. Teachers are advised to make themselves familiar with the syllabi of the subjects they are to teach, and to plan definitely on paper their class work in every subject before the school opens in the autumn. Any letters asking for assistance in interpreting doubtful statements, directed to the Department, will receive prompt attention.

No claim is made that the Manual is either complete or perfect. It is the first attempt on the part of the Department to get out such a publication, and, doubtless, is lacking in many particulars. As the Manual will be revised from time to time, any criticisms or suggestions looking to its improvement will be gladly welcomed.

All teachers are urged to supply themselves with some of the recent books bearing on their profession, and endeavor through close reading to widen the range of their professional knowledge. This is the day of educational advancement and the unprogressive teacher will soon be left behind. Principals are especially urged to organize teachers meetings for the purpose of studying through reading and discussion with their teachers some of the fundamental educational problems. The books suggested in the Manual are all helpful. Others will be recommended on application.

A handwritten signature in cursive script, reading "Harry Funnels". The signature is written in dark ink and is positioned above the printed title "Supt. of Education.".

Supt. of Education.

RULES AND REGULATIONS.

Adopted by the High School Commission for the Government of the County High Schools of Alabama.

1. The county board of education shall nominate the teachers for the county high school and the nomination shall be sent to the High School Commission for approval. The board in sending in the nominations shall suggest the salary to be paid each teacher.

2. The teachers of the county high school shall consist of a principal and two or more assistants, and every teacher must hold an Alabama First Grade or Life Certificate.

3. The principal shall be employed for the whole year and his term of service shall begin July 1st and end June 30th of the following year, and he shall be paid by the calendar month. The assistant teachers shall be employed for nine months (36 weeks) and shall be paid by the scholastic month. The salary of each assistant teacher shall begin when the regular session opens.

4. The teachers shall keep an accurate record of the daily recitations and conduct of the pupils, and at the end of each term make a general report of each pupil to the principal, who shall place this report on a general record book which shall be well bound and kept for future reference. The principal shall keep a matriculation book in which shall be placed the names of the pupils as they matriculate, giving the full name, home address, age, and any other desired information. No pupil under thirteen years of age shall be allowed to matriculate.

5. It shall be the duty of the principal at the end of the ninth month to make a report on blanks furnished by the Department of Education. This report shall be made in duplicate,

one copy being sent to the county superintendent and the other to the Superintendent of Education at Montgomery. It shall also be the duty of the principal to make reports from time to time when called for by the Department of Education.

6. It shall be the duty of the principal and assistants in each county high school to follow faithfully the course of study prescribed by the Superintendent of Education, in accordance with section 1866 of the Code.

This course of study shall be a four year course and shall be based on an elementary course of seven grades or years .

7. The county high school shall begin its annual session on such date as may be fixed by the county board of education.

8. The session of the county high schools shall be nine scholastic months (thirty-six weeks). The session is divided into two terms of four and a half months each, and at the end of each term a general written examination shall be given to the pupils on the branches studied during the preceding term.

9. The holder of an unexpired second grade certificate issued by the State Board of Examiners or a written statement from a teacher who holds a first grade certificate issued by the State Board of Examiners, stating that the holder has taken the elementary course of study as prescribed by the Department of Education in his or her school and has passed a satisfactory examination on these branches through the seventh grade, shall be entitled to entrance in the county high school without further examination. Every applicant who is not eligible to entrance without examination as stated in this rule shall be required to stand a satisfactory written entrance examination on the branches included in the elementary course of seven years' work by the principal and teachers of the county high school. Each applicant shall be required to make not less than 50 per cent on each elementary branch and his general average shall be not less than 75 per cent.

10. During the vacation period the principal shall canvass the county in the interest of the county high school, or perform any other general school work that may be assigned to him by the High School Commission and county board.

11. All teachers must attend the county and district institutes and also the annual meeting of the Alabama Education Association. The time used in attending these meetings will be counted as time taught.

12. A pupil living in any county may attend the county high school in another county without any additional charges for tuition, etc., but every pupil in the county high school must present to the principal his receipt at the beginning of each term of the session showing that an incidental fee of \$2.50 has been paid to the local treasurer of the high school which he is to attend.

13. Every county high school must have a treasurer who shall reside in the place where the school is located. The treasurer shall be elected by the county board of education, subject to the approval of the High School Commission, for a term of three years and shall be required to make a bond of \$3,000 in a reputable surety company; said bond must be approved by and filed in the office of the probate judge of the county in which the high school is located, and a certified copy of this bond must be filed in the office of the Department of Education at Montgomery. The treasurer shall keep in a well-bound book accurate accounts and shall make reports as to the financial condition of the high school whenever the county board and High School Commission require it. He shall keep an accurate account of receipts and disbursements of all moneys, stating from what source they came and how disbursed, giving receipts and taking proper vouchers.

14. The principal of the school on the 20th day of each calendar month shall make a pay roll for the salaries of the teachers due, together with whatever accounts may have accrued against the school, and after approving it shall file the same with the county superintendent of education who shall examine it and after approving shall send the pay roll to the Superintendent of Education at Montgomery. After the pay roll has been approved by the Governor, the Superintendent of Education shall return it to the local treasurer of the county high school. The treasurer shall then issue a check to cover

each item on the pay roll and opposite each item he shall place the number of the check paying such item. When checks are handed to the teachers they shall receipt the pay roll in the regular "signature column." All local bills must be receipted for in the same manner when practicable. It shall be the duty of the treasurer to place and keep all canceled checks in the proper pay rolls when the checks are returned to him from the bank, which checks may serve as duplicate vouchers.

15. It shall be the duty of the treasurer to pay all items with checks stating on the check the nature of the item paid. The treasurer shall pay out no funds for any item until the account therefor has been regularly placed on the pay roll which must be made out and approved by the principal of the school, the county superintendent of education for the county board, and by the Governor for the High School Commission.

16. The Treasurer of the County High School shall, on the last day of each month, make to the Secretary of the High School Commission an itemized statement of all funds received by him during the month exclusive of the quarterly auditors warrant.

17. The treasurer must make an annual report of the receipts and disbursements at the close of the ninth scholastic month each year. One of these reports shall be filed with the county superintendent and the other with the Superintendent of Education at Montgomery.

18. The treasurer shall be paid no salary, but the premium on his surety bond and any incidental expenses connected with his official duties must be paid from local supplement funds.

19. It shall be the duty of the principal to attach to each monthly pay roll an itemized statement of any incidental account to be paid.

20. The quarterly state appropriation of \$500 shall be made payable to the order of the high school treasurer and be drawn on January 1st, April 1st, July 1st, and October 1st of each year, and the requisition therefor must be signed by the county superintendent of education for the county board and by the Governor of the State for the High School Commission. It shall be the duty of the chief clerk in the Department of Ed-

ucation to receipt the State Auditor for the warrant which shall be sent by said chief clerk to the high school treasurer.

21. Examinations must be held at the close of each term of four and a half months by the high school teachers and at the close of the session a certificate shall be issued to each pupil who passes a satisfactory examination stating that such pupil has finished the work of a designated year and this certificate shall entitle the pupil to enter upon the work of the year next after that so designated, in any county high school in the State.

22. In order to pass a satisfactory examination on a particular branch in the county high school it is necessary for the pupil to make an average of not less than 60 per cent on a branch in the first year's work, 65 per cent on a branch in the second year's work, 70 per cent on a branch in the third year's work, and 75 per cent on a branch in the fourth year's work. This average shall be secured by averaging the grade made on final examinations with the daily recitation grades given, the final examination counting *one-third* and the daily recitations *two-thirds*. All examination papers shall be held for reference until January 1st of the succeeding year.

23. The county high school teachers shall hold teachers' meetings twice each month of the scholastic year at which the theory and practice of teaching the various high school branches shall be studied and discussed.

24. The High School Commission shall appoint from time to time High School Inspectors, who shall visit the various county high schools of the State and after carefully inspecting them shall make a written report to the Secretary of the High School Commission.

25. The principal and assistants of each county high school are hereby authorized to make such rules and regulations as they may deem necessary to successfully control and discipline the school, provided such rules and regulations shall in no way conflict with the rules and regulations made by the High School Commission.

COURSE OF STUDY

For the County High Schools of Alabama.

(Based on elementary course of seven grades or years.)

First Year.

| | No. of recitation periods per week. |
|--|--|
| ENGLISH.—Grammar reviewed, Rhetoric and composition, and Classics----- | 5 |
| MATHEMATICS—Arithmetic reviewed, (first half-year) ; Algebra (second half-year)----- | 5 |
| HISTORY.—English History ----- | 3 |
| SCIENCE.—Physical Geography, (3 periods per week for first half-year, and 3 periods per week for second half-year until March when Agriculture is taken up)----- | 3 |
| Agriculture, (3 periods per week during March, April and May)----- | |
| MANUAL TRAINING AND DRAWING—Geometrical Drawing ----- | 2 |
| ELECTIVE.—(One of the following)----- | 5 |
| LATIN.—Beginner's ----- | 5 |
| GERMAN.—Grammar and Composition, easy reading ----- | 5 |
| COMMERCIAL GEOGRAPHY ----- | 5 |
| SCHOOL GARDEN WORK. | |
| Required periods----- | 23 |

Second Year.

| | No. of recitation periods per week. |
|--|--|
| ENGLISH.—Rhetoric and Composition, and Classics-- | 5 |
| MATHEMATICS.—Algebra to Quadratics, (first half- year); Plane Geometry, (second half-year) ----- | 5 |
| HISTORY.—Ancient History to 800 A. D.----- | 3 |
| SCIENCE.—Biology, 3 periods per week during entire year; Agriculture, 1 period per week during entire year ----- | 4 |
| MANUAL TRAINING AND DRAWING—Mechanical Drawing or Linear Drawing----- | 2 |
| ELECTIVE.—(One of the following) ----- | 5 |
| LATIN.—Caesar, 4 books; or Viri Romae and 3 books of Caesar; Grammar and Prose Composition ----- | 5 |
| GERMAN.—Grammar and Composition, reading of intermediate texts ----- | 5 |
| COMMERCIAL ARITHMETIC ----- | 5 |
| SCHOOL GARDEN WORK. | |
| Required periods ----- | 24 |

Third Year.

| | |
|---|----|
| ENGLISH.—History of English Literature, Composition and Classics ----- | 5 |
| MATHEMATICS.—Plane Geometry, (first half-year); advanced Algebra, (second half- year) ----- | 5 |
| HISTORY.—Mediaeval and Modern History----- | 3 |
| ELECTIVE.—(Two of the following)----- | 10 |
| LATIN.—Cicero, 6 orations; or Cicero's Letters and 4 orations; Grammar or Prose Composition ----- | 5 |
| FRENCH.—Grammar and Composition, reading of easy texts ----- | 5 |

| | |
|--|----|
| GERMAN.—Same as in first year----- | 5 |
| BOOKKEEPING ----- | 5 |
| PHYSICS AND AGRICULTURE—Physics 4 periods per week, and Agriculture 2 periods per week during entire year----- | 5 |
| SCHOOL GARDEN WORK. | |
| Required periods----- | 23 |

Fourth Year.

| | |
|--|----|
| ENGLISH.—American Literature, Composition and Classics, and Advanced Grammar----- | 5 |
| MATHEMATICS.—Advanced Algebra, (first half- year); Solid Geometry or Arithme- tic, (second half-year)----- | 5 |
| HISTORY.—U. S. History and Civics, Alabama History | 4 |
| ELECTIVE.—(Two of the following)----- | 10 |
| SCIENCE.—Chemistry and Agriculture, (Chem- istry 5 periods per week during first half-year and 3 periods per week during second half-year; Agricul- ture 2 periods per week during sec- ond half-year) ----- | 5 |
| LATIN.—Vergil, 6 books; or 1500 lines of Ovid's Metamorphoses and 4 books of Vergil | 5 |
| FRENCH.—Grammar and Composition, reading of intermediate texts ----- | 5 |
| GERMAN.—Same as in second year----- | 5 |
| BOOKKEEPING AND COMMERCIAL LAW | 5 |
| SCHOOL GARDEN WORK. | |
| Required periods ----- | 24 |

Note:—1. If a foreign language (Latin, French, or German) is elected, it must be pursued consecutively *at least two years*. Standard colleges will give no credit for one-year courses in these languages. It is advisable that Latin, when once begun, be pursued during the entire four years.

Text-book work in Biology, Physics, and Chemistry must be supplemented by laboratory experiments performed by the pupils. Each pupil will be required to keep a record of his laboratory work in a note book and to submit it to the High School Inspectors for examination whenever called upon.

School Garden Work is a part of the course in Agriculture.

The length of the recitation period must be not less than forty minutes and not over forty-five minutes.

A certificate indicating the units or subjects completed will be granted at the close of the first, second and third years. A diploma will be given upon the completion of the fourth year.

The number of Elective Courses offered in each year will be determined by the teaching force. Schools having only three teachers cannot offer as many elective studies as schools in which four or more teachers are employed.

A high school unit is defined as a subject which has been pursued successfully during a school year of thirty-six weeks, five recitation periods per week, the periods being not less than forty minutes in length. For instance, biology in the second year is counted as three-fifths of a unit. Two periods of laboratory work are equivalent to one recitation period in counting units.

LIST OF TEXT BOOKS FOR COUNTY HIGH SCHOOLS.

First Year.

- ENGLISH—Reed and Kellogg's Higher Lessons in
 English-----Chas. E. Merrill Co.
 Brooks and Hubbard's Rhetoric and
 Composition-----American Book Co.
 Gateway Series of English Classics
 -----American Book Co.
 Other Classics (See pages 31-33 of Manual.)
 Southern School Book Depository, Atlanta, Ga.
- ARITHMETIC—Colaw and Elwood's Advanced
 -----B. F. Johnson Pub. Co.
- PHYSICAL GEOGRAPHY—Maury-Symonds—
 -----American Book Co.
- ALGEBRA—Collins' Practical Elementary Algebra
 -----American Book Co.
- LATIN—Pearson's Essentials-----American Book Co.
- HISTORY—Walker's Essentials in English History
 -----American Book Co.
- GEOMETRICAL DRAWING—Kitchners' Geomet-
 rical Note Book -----The MacMillan Co.
- GERMAN—Joyne's Wesselhoef's German Gram-
 mar-----D. C. Heath & Co.
 Wesselhoef's German Composition----
 -----D. C. Heath & Co.
 Huss' German Reader -----D. C. Heath & Co.
- AGRICULTURE—Duggar's Agriculture_The MacMillan Co.

Second Year.

- ENGLISH—Brooks and Hubbard's Rhetoric and
Composition.....American Book Co.
Gateway Series of English Classics
.....American Book Co.
Other Classics (See pages 31-33 of Manual.)
Southern School Book Depository, Atlanta, Ga.
- ALGEBRA—Collins' Practical Elementary Algebra
.....American Book Co.
- GEOMETRY—Wentworth's Plane and Solid....Ginn & Co.
- HISTORY—Wolfson's Essentials in Ancient His-
tory.....American Book Co.
- BIOLOGY—Bailey and Coleman's Biology.....
.....The MacMillan Co.
- DRAWING—Davidson's Linear Drawing.....
.....Hinds, Noble & Eldredge.
- BOTANY—Bergen's Botany.....Ginn & Co.
- LATIN—Harkness and Forbes Caesar..American Book Co.
Pearson's Latin Composition, (Caesar)
.....American Book Co.
Harkness' Complete Latin Grammar....
.....American Book Co.
Arrowsmith & Knapp's Selections from
Viri RomaeAmerican Book Co.
- GERMAN—Joyne's Wesselhoeft's German Gram-
mar.....D. C. Heath & Co.
Wesselhoeft's German Composition....
.....D. C. Heath & Co.
Storm's Immensee, Heyse's L'Arrabiata
.....D. C. Heath & Co.
Der Schwiegersohn, Nicotiana.....
.....D. C. Heath & Co.
- COMMERCIAL ARITHMETIC—Moore's New
Commercial.....American Book Co.
- AGRICULTURE—Duggar's Field Crops..The MacMillan Co.

Third Year.

- ENGLISH—Halleck's History of English Literature-----American Book Co.
 Wooley's Handbook of English Composition-----D. C. Heath & Co.
 Gateway Series of English Classics
 -----American Book Co.
 Other Classics (See pages 31-33 of Manual.)
 Southern School Book Depository, Atlanta, Ga.
- GEOMETRY—Wentworth's Geometry-----Ginn & Co.
- ALGEBRA—The Essentials of Algebra, (Aley & Rothrock)-----Silver, Burdett & Co.
- PHYSICS—Higgin's Physics-----Ginn & Co.
- LATIN—Harper & Gallup's Cicero's Orations and Selections from the Letters--American Book Co.
 Pearson's Latin Prose Composition (Cicero)-----American Book Co.
- FRENCH—Francois' Beginners' French--American Book Co.
 Une Semaine a Paris-----American Book Co.
 Trois Contes Choisis-----American Book Co.
- HISTORY—Harding's Mediaeval and Modern History-----American Book Co.
- COMMERCIAL GEOGRAPHY—Redway's Commercial Geography-----Chas. Scribner's Sons.
- BOOKKEEPING—Office Methods and Practical Bookkeeping, Complete System-----Powers & Lyons.
- AGRICULTURE—Goff's Symposium of Horticulture — University Co-operative Co., Madison, Wis.

Fourth Year.

- ENGLISH—Simond's History of American Literature-----Houghton, Mifflin & Co.
 Whitney's Essentials of English Grammar-----Ginn & Co.
 Gateway Series of English Classics
 -----American Book Co.
 Other Classics (See pages 31-33 of Manual.)
 Southern School Book Depository, Atlanta, Ga.
- ALGEBRA—The Essentials of Algebra, (Aley & Rothrock)-----Silver, Burdett & Co.
- GEOMETRY—Wentworth's Geometry-----Ginn & Co.
- ARITHMETIC—Sensenig and Anderson's Complete Arithmetic-----Silver, Burdett & Co.
- HISTORY—Hart's Essentials in American History
 -----American Book Co.
- CIVICS—James and Sanborn's Government in State and National-----Chas. Scribner's Sons.
- LATIN—Harper and Miller's Vergil-----American Book Co.
 Gleason's, A Term of Ovid-----American Book Co.
- COMMERCIAL LAW—White's Business Law-----
 -----Silver, Burdett & Co.
- FRENCH—Douay's French Reader-----Silver, Burdett & Co.
 Fasnacht's French Grammar—The MacMillan Co.
 L'Abbe Constantin, LaMare au Diable
 -----D. C. Heath & Co.
- BOOKKEEPING—Office Methods and Practical Bookkeeping, Complete System-----Powers & Lyons.
- CHEMISTRY—Smith's Essentials of Chemistry--
 -----Benj. H. Sanborn & Co.
- AGRICULTURE—Snyder's Chemistry of Soils and Fertilizer-----The MacMillan Co.

ENGLISH.

By PROFESSOR J. R. RUTLAND

1. Aims.

The teaching of English in schools has three distinct aims: correct speaking, correct writing, and good reading. The course must not only teach rules and facts, but fix habits of clear expression and of reading the best books. A literary and linguistic conscience, or good taste, is to be formed which will guide the boy and girl to a full, rounded, cultured manhood and womanhood. The teacher should not only keep definitely in mind these aims as they appear in various forms in every lesson of the year but also make subservient to his purpose all the changing fancies, flowering ambitions, overflowing emotions of the growing boy and girl. In a tactful and enthusiastic way he should make every faculty of the child and every opportunity of the day pay tribute to his work. To teach children to express themselves clearly, correctly, and forcefully and to acquire a taste for good literature is not an easy task. It calls for patient planning, unremitting and often apparently unrewarded labor. Unfortunately, children's home and social environment have before the school years often fixed habits of incorrect speech and shut up their minds to the appeal of the beautiful, the good, and the true in language and literature. To attain these high aims with such unformed material requires all that a teacher can command of love and knowledge of the work and of enthusiastic interest in children and in culture.

One of the ways of accomplishing this task is by a thorough study of grammar. Here there should be no lack of the old-fashioned grammatical drill, parsing, and analysis. Both pupils and teacher should see that grammar deals with thought as well as with forms and the recitation should never degenerate into rote-work or parroting. Use in the sentence must

determine the class to which a word belongs. Correcting false syntax—especially the frequent mistakes of the pupils—constant reviews, practical and concrete teaching with examples or illustrations of principles, outside, independent work of the pupils, written tests in class, analysis of sentences in literature, are some of the methods of making instruction in grammar more effective. The service of grammar to composition and to the study of literature should be kept constantly fresh.

In teaching composition, the only satisfactory method requires a great deal of writing during all of the four years of the high school course. A theme a week is a minimum. However, the teacher should never give more than he is able to read. During the first year, there should be very little criticism and not much formal study of the rules of rhetoric. These should be taken up in class orally and illustrated by pupils' themes, while the text is used merely as a guide. Every way of making writing a pleasure, of drawing out the pupils' ideas in the written sentence should be resorted to. Writing, if possible, should become as natural as speech, the quick retort or hearty congratulation. Before the more formal study of the principles and kinds of composition are taken up in the third and fourth years, the class should be able to write correct sentences, with good spelling and punctuation, and to know the meaning of the paragraph. Care should always be taken in making assignments to be sure that the pupils understand what is desired. At first the teacher must outline almost all the pupils are expected to write. The teacher must, even to the point of baldness, put himself on the level of his pupils. Gradually he can lead them upward after he once vitally lays hold on them till he can depend on their own developed originality.

The reading of good books will furnish inspiration to this work. Frequent imitations are good. The first thing necessary in teaching literature to children is to inculcate a desire to read and a taste for it. In fact, the chief thing to do in the high school is to engage their interest and inspire them to read. Sometimes to accomplish this, teachers find it necessa-

ry to select other books than the "classics." After a liking for good books is formed, the more serious study of the content, or meaning of words, sentences, paragraphs, and books, with some simple conceptions of form and structure of the various kinds of composition may be studied. The cultivation of taste for the expressive, the lovely and the artistic, the arousal of the moral ideas inseparably connected with art, the exploration of human nature, emotions, thought, insight in books are aims in every course in literature. Very frequently if the pupils are made to realize that literature reproduces real life, deals with true people and actual motives, their interest can be immediately aroused. The problem of the teacher then is to sustain this interest and the taste for the good will come of itself, for this the teacher can deal with only indirectly by encouragement and co-operation. In this work, teachers should remember that the literature itself is to be taught. History of literature, facts about the author and his times are necessary but of secondary importance and interest to the child. The appreciation of the conception and the art of the writer should not be marred by a too minute study of words and phrases. "The letter killeth" very effectively if emphasis is placed on it too early. If the high school teacher has taught his pupils to glean the thought of a piece, to appreciate and enjoy the creation of the writer, its humanity and its beauty of art, and has fixed the habit of reading good books, he has done his work well.

Arrangements of Periods for Each Week.

| Years | | Terms | |
|--------|--|-------|--------|
| | | First | Second |
| First | Grammar ----- | 2 | 1 |
| | Composition ----- | 1 | 2 |
| | Literature (Classics) ----- | 2 | 2 |
| Second | Composition ----- | 3 | 3 |
| | Literature (Classics) ----- | 2 | 2 |
| Third | Composition ----- | 2 | 2 |
| | English Literature ----- | 2 | 2 |
| | Classics ----- | 1 | 1 |
| Fourth | American Literature including Southern Literature ----- | 2 | 2 |
| | Composition ----- | 2 | 1 |
| | Classics ----- | 1 | 1 |
| | Advanced Grammar (at the teacher's discretion) ----- | -- | 1 |
| | | | |

III.

Grammar.

The study of grammar in the first year of the high school must include a thorough study of the sentence form. A clear understanding of its parts (the subject, predicate, complements, modifiers, connectives, and independent elements), and their relation to the rest of the sentence must be aimed at in the beginning. Special attention should be given to the complementary parts (direct object, objective and attribute complements, etc.), and to the predicate (verb phrases, auxiliaries,

showing mood and tense, etc.), and to various kinds of modifiers, (adjective, adverb, phrase, clause, etc.). This last will require, of course, a study of the complex sentence and will lead to the classification of sentences according to form, (simple, compound and complex), and according to use (declarative, interrogative, imperative and exclamatory). When the sentence form has been sufficiently mastered and the pupils can readily analyze it into its parts, defining the function of each, a more abstract study of the parts of speech should be taken up. Constant drills, varied by game devices perhaps, must be resorted to in order to classify the pupils' knowledge in as comprehensive a system as the maturity of their minds will allow; but drills should not be carried to such excess that the pupils are not compelled to analyze. In the study of nouns, pronouns, and adjectives, close attention must be given to use, forms, classes, and modification. The pupils must get a clear idea of the meaning of number, person, case and gender in modern English. In the study of verbs, care should be taken that the forms are so well fixed in the pupils' minds that the teacher's call for the form of a certain verb in any tense, mood, and voice will get an immediate reply. The teacher should be sure that the uses of the passive voice, of the imperatives, of the participles, and verbal nouns are made clear. It will be found profitable to combine with this old-fashioned method of learning the rules, exercises by which the pupils are taught to recognize the forms, analyze the combinations, and explain the agreements and uses of the verb. Oral parsing, review of the conjugations, critical analysis and definition of forms and uses should be constantly resorted to. When the study of adverbs, prepositions, conjunctions, adjectives, expletives, phrases, and clauses has been completed, a review of the more difficult points should be attempted by way of a general review that should organize the pupil's grammatical information.

During the second term of the fourth year, one hour a week may be devoted to a review of grammar. The outline to be followed will be practically the same as in the first year; but of course the manner of treatment will be more theoretical.

Besides the mere organization and expansion of the pupils' grammatical knowledge, the study will afford considerable training in analysis and argument. For students going to college, this study should be a good basis for further progress in word-study and philology; for the student going to work, it should correct and elevate his linguistic conscience. The elementary study of words, their roots, inflection, derivation and composition, with which the pupils should have been made familiar, incidentally in connection with the study of literature, can now be pursued with interest and with profit. It should be remembered that the pupils will have little need of principles of grammar which are not extremely practical for their guidance in spoken and written English.

IV.

Composition.

During the first two years the principles of composition as related to the sentence and the paragraph should be taught orally and through the theme work. The children can do little by themselves with the text. Constant practice in sentence making, paragraph building, simple outlining, is absolutely necessary and this the teacher must explain and illustrate in class over and over before the pupils are required to do entirely independent work. While narrative and descriptive writing will predominate during the first two years, simple argument and exposition should not be neglected. Simple explanations and definitions, giving reasons for belief or action, telling how to make things, will offer many opportunities for these forms. Oral recitation, where the pupil proceeds from point to point without help, is good drill in following an outline. Unpretentious attempts at story telling, reproduction of stories and descriptions, read in or out of class, comments and discussions of all kinds that naturally grow out of the study of literature and out of the general reading of the pupils, oral or written exploitations of the pupils' general knowledge and personal

experience should be skillfully encouraged by the teacher. Letter writing, because of its intimate personal nature, because it requires correctness and neatness of form, and because it may be adapted to any form of composition, should be frequently used.

In the third and fourth years sentence, and paragraph, and outline making; unity, coherence and emphasis; point of view, kinds of composition and other facts and principles should be taken up more formally with the book. Theme work in exposition and argument, though by no means excluding narrative and description, should consume the larger part of the time. Longer themes and more difficult topics are in order. As far as possible all composition work should grow naturally out of the school work and life, out of interest in the business life to come, and out of the personal experience of the children. More pretentious imitations in verse or prose; another chapter of Robinson Crusoe or Gulliver's Travels, rhyming witticisms, scenes of drama, and like exercises ought to be attempted. As far as possible, the pupils should be taught to skirmish about in literature for themselves for suggestions as to the form which they will give to their own ideas. Independence and self-confidence, as well as the faculty of self-criticism, should be cultivated tactfully from the beginning. It can not be emphasized too much that the teacher must explain by precept and example every process he requires his pupils to go through with. Criticisms should always be sympathetic and pupils should generally make their own corrections. Above all, the teacher must help the pupil in innumerable ways to enrich his thought and feeling by observing and reading, so that he will have something to write. He will then want to write.

Conferences.

As much time as possible should be given to individual conferences on the written work of the pupils. The suggestions and criticisms in class and the comments written on the pupils' themes can not take the place of the personal interview in which pupil and teacher can be perfectly frank.

Literature.

In the first years of the high school the main purpose in the reading of a poem or story or speech is to get an appreciative response from every child in the class. Of course the class must learn something about the life of the author, his place in history, the structure of the piece and the allusions, but in the first year these things, which should come chiefly from the teacher, are of minor importance in comparison with the main purpose and charm of the masterpiece. Outside reading, easy and attractive to young people, whether "classic" or not, will help stimulate a love for the best books. The attitude of the teacher should always be that of an enthusiastic reader, and by no means that of a task-master. Striking phrases and lines should be memorized from day to day by both teacher and pupil. In the second year closer attention should be given to both content and form. Minute familiarity with the incidents and characters of a story or with the points of an essay should be insisted upon. The study of the meanings of words, allusions, figures, meaning of whole piece, qualities of style, and personality of the writer should not be made too exacting or severe. The relation of literature to life is always engaging. In every masterpiece studied, the human interest, the ideas, activities, emotions found there, which should be realized and understood as natural and desirable or undesirable in actual life, are of considerably more importance to the second year pupil than its form or structure. The interpretation of the writer's feeling, as well as thought, by means of the voice, should get a great deal of emphasis in all of the four years.

The third year marks a significant change of plan with regard to literature. The work in the second and first years has been mainly with those classics which the committee on college entrance requirements in English have called "books for reading." Now in addition to these, it is advisable to take up those which are assigned "for study" and also to pursue with the aid of a special text, in a more or less chronological

order the study of the chief writers of England. In a consecutive study of Englishmen of letters, the teacher should select from the whole list those who are best, those who are most significant representatives of their respective periods, and whose writings have a special appeal to boys and girls of the high school age. The following are suggested: Chaucer, Raleigh, Spenser, Bacon, Shakespeare, Milton, Bunyan, Dryden, Defoe, Swift, Addison, Pope, Johnson, Goldsmith, Burke, Burns, Scott, Wordsworth, Coleridge, Lamb, De Quincey, Byron, Shelley, Keats, Macaulay, Dickens, Thackeray, Carlyle, George Elliot, Ruskin, Arnold, Tennyson, and Browning. A text-book of selections of English poems should be used in connection with a history of literature. The various series of classics may be drawn upon for the prose. It is most inadvisable to study a history of literature without using in class selections from the great writers, and the emphasis should be laid on the masterpieces, not on the history.

However, besides the more outstanding facts about literature and great writers which children ought to know, they should learn something definite about the forces at work in each period, which expressed themselves in certain forms and kinds of writing. Some idea of the progress or changing values of thought must be obtained. Ward's "English Poets" and Palgrave's "Golden Treasury of Songs and Lyrics" (which is included with classics for college entrance) will be especially helpful in this study. If the pupils are not already accustomed to the use of notebooks, the practice should now be begun. In them should be kept not only the meanings of unusual words, allusions or special notes of any kind on the text of the classics studied, but also facts about the author's life and about the period in which he lived, a list of his other works, and such of his characteristics as the pupils have found indicated in his poem or book. To see that these books are neatly and intelligently kept, the teacher ought to examine them at least once a month. In the intensive study that is expected of third year pupils, who in the other years have step by step been led to see some of the beauties and understand some of the values of literature, the pupils must know how to read carefully and in-

telligently, to get the thought. Both the mental development of the pupil and the demands of the course will require greater application and more difficult masterpieces. Hard words and difficult allusions will be more frequent. Greater attention must be given to the form and its relation to the message and purpose of the writer. Some attention has already been given to the more obvious facts of poetical and dramatic technique. This should be continued, always with regard for the immaturity of the students, and something of the structure of the story, novel, oration, and essay may be added incidentally with the study of the pieces.

For close reading and study are provided by the committee on uniform entrance requirements in English a play, group of poems, an oration, and an essay, which are to be selected from the following: Shakespeare's "Macbeth," Milton's "L'Allegro," "Il Penseroso," and "Comus," Burke's "Speech on Conciliation with America," or Washington's "Farewell Address," and Webster's "First Bunker Hill Oration" and Macaulay's "Life of Johnson," or Carlyle's "Essay on Burns." Two of these should be studied during the third year and two during the fourth. In this part of the work emphasis must be placed upon "the content, form and structure, and upon the meaning of such words, phrases, and allusions as may be necessary to an understanding of the works and an appreciation of their salient qualities of style." However, this minute study should not be carried on in such a matter-of-fact way as to make it distasteful to the pupils. The main object is appreciation.

In the field of American literature, which is to be studied in the fourth year, it is well for the teacher to determine, as he did for the English writers, upon a representative list of American literary masters, and base the class work entirely upon them. Franklin, Irving, Cooper, Bryant, Poe, Emerson, Hawthorne, Thoreau, Whittier, Longfellow, Holmes, Whitman, Lowell should be included. To these may be added Hayne, Timrod, Lanier, Ryan, and a few other Southern writers. A good collection of American poetry and a text of Southern poetry will be necessary. For the prose, the teacher will find nearly all he needs in the various series of classics. This should be

definitely planned at the beginning of the year so that the pupils may provide themselves in time with the proper texts. A simple text on the history of American literature must be used. While a knowledge of the author and his life is of value in interpreting his poems, essays, or stories, it is quite as necessary to study his personality and his opinions through his literary products. In the same way an acquaintance with the period in which the writer lived is excellent preparation for studying his works; it is also true that the works themselves will reflect a great interest on the time which produced them. But in this study, the poem and the poet, the essay and the essayist, the story and the novelist, the thought and the personality, the beauty and the creator, are more significant than the times which brought them forth. The order of importance is usually the poem, the poet, and lastly the age. The history is a setting for the poet and the poem, which relates them to their past, present and future; and, therefore, is of secondary interest to the high school teacher of English. This year the maturity of the students' mental powers and the training of the previous session should allow of a more exacting, accurate, critical study of the form, structure, style, and content. They should be conscious of an increasing ability to read carefully, intelligently, and appreciatively. They should practice analyzing and outlining the thought expressed, pointing out qualities characteristic of the author and the times, and stating in definite terms appreciation of the author and of his style.

Those classics to be studied closely should be subjected to the same careful application. Possibly Milton's "L'Allegro," "Il Penseroso," and "Comus," and Burke's "Conciliation with America" have been reserved for this year. Special attention will be given among other things, to words, allusions, qualities of style, principles of composition illustrated, poetic forms, and structure of argument. During both the third and fourth years the appreciative study, with less vigorous application, of other classics should, for the sake of variety, be combined with this more exacting work. This class work and the recommended outside reading should include in the four high school years practically all those classics listed as "College Entrance

Requirements in English." While the amount of reading expected of the pupils will necessarily be left to the teacher's discretion, his judgment must be guided not only by the requirements of the course, but also by the needs of the growing boys and girls. He must be quick to discern personal preferences and patient in directing them.

VI.

Useful Books for the Teacher and Pupils.

(a) Teaching of English.

Chubb: The Teaching of English. (The Macmillan Company.)

Bates: Talks on the Study of Literature. (Houghton, Mifflin Company.)

Bates: Talks on writing English (Houghton, Mifflin Company.)

Heydrick: How to Study Literature. (Hinds and Noble.)

McMurry: Special Method in the Reading of English Classics. (Macmillan.)

Carpenter, Baker and Scott: The Teaching of English. (Longmans.)

Woodward: English in the Schools. (Heath.)

Blakely: Teachers' Outlines for Studies in English. (American Book Co.)

Palmer: Self-cultivation in English. (Crowell.)

(b) Composition and Rhetoric.

Wendell: English Composition. (Scribner.)

Gardner: The Forms of Prose Literature. (Scribner.)

Webster: Composition. (Heath.)

Brooks and Hubbard: Rhetoric and Composition. (American Book Co.)

Lockwood and Emerson: Rhetoric and Composition for Higher Schools. (Ginn & Co.)

Baker and Huntingdon: Principles of Argumentation. (Ginn.)

Gardner, Kittredge, and Arnold: Composition and Rhetoric. (Ginn.)

Thomas: Manual of Debate. (American Book Co.)

(c) Grammar and Language Study.

Trench: Study of Words. (Armstrong.)

Greenough and Kittredge: Words and Their Ways in English Speech. (Macmillan.)

Emerson: Brief History of the English Language. (Macmillan.)

Sweet: New English Grammar Logical and Historical. (Clarendon Press.)

(d) Literature.

1. Ward: English Poets, 4 volumes, (Macmillan.)

1. Craik: English Prose, 5 volumes. (Macmillan.)

1. Manly: English Poetry. (Ginn.)

1. Page: Poets of the Nineteenth Century. (Sanborn.)

1. Page: Chief American Poets. (Houghton, Mifflin and Co.)

1. Stedman: American Anthology.

1. Painter: Poets of the South. (American Book Co.)

1. Webber: Southern Poets. (Macmillan.)

1. Syle: From Milton to Tennyson. (Allyn and Bacon.)

1. Pancoast: Selected English Poems. (Holt.)

2. Henschman and Gunmore: Lives of Great English Writers. (Houghton, Mifflin.)

2. Halleck: History of English Literature. (American Book Co.)

2. Brooks: English Literature to the Norman Conquest. (Macmillan.)

2. Schofield: English Literature from the Norman Conquest to Chaucer. (Macmillan.)
2. Saintsbury: History of Elizabethan Literature. (Macmillan.)
2. Gosse: Eighteenth Century Literature. (Macmillan.)
2. Saintsbury: History of Nineteenth Century Literature. (Macmillan.)
2. Taine: History of English Literature.
3. Wendell and Greenough: The History of Literature in America.
3. Bronson: History of American Literature. (Heath.)
3. Simond: History of American Literature. (Houghton Mifflin & Co.)
3. Noble: History of American Literature. (Macmillan.)
4. Ryland: Chronological Outlines of English Literature. (Macmillan.)
5. Gayley: Classic Myths in English Literature. (Ginn.)
5. Fairbanks: The Mythology of Greece and Rome. (Appleton.)

VII.

CLASSICS.

The classics named here are those listed as college entrance requirements. They are arranged in four groups which may be used consecutively during the four high school years. It seems none too much to expect a high school teacher to acquaint his pupils with all these or the equivalent by means of class work on those "for reading" and "for close study" and by means of outside reading. It is not hard to see how a good teacher could considerably increase the number. Not less than four a year selected from prescribed group must be taken by each class. Care should be taken to see that the edition of classics used is well edited. It is hoped that the teacher will supplement this list with many other good books.

First Year.

Franklin's, Autobiography.
 Defoe's, Robinson Crusoe.
 Longfellow's, Miles Standish.
 Bunyan's Pilgrim's Progress.
 Stevenson's, Treasure Island.
 Shakespeare's, Merchant of Venice.
 Irving's, Rip Van Winkle and other Sketches.
 Palgrave's, Golden Treasury (selections).
 Whittier's, Snow Bound.
 Scott's, Lady of the Lake.
 Bible—Old Testament Stories.

Second Year.

Homer—Stories from Iliad and Odyssey.
 Addison—Sir Roger de Coverley Papers.
 Palgrave's, Golden Treasury (selections).
 Scott's, Ivanhoe.
 Scott's, Quentin Durward.
 Goldsmith's Deserted Village.
 Stevenson's, Inland Voyage.
 Stevenson's, Travels with a Donkey.
 Coleridge's, Ancient Mariner.
 Macaulay's, Lays of Ancient Rome.
 Arnold's, Sohrab and Rustum.
 Virgil's, Aeneid.
 Hawthorne's, House of Seven Gables.

Third Year.

Poe's, Raven.
 Lowell's, Vision of Sir Launfal.
 Palgrave's, Golden Treasury (selections).
 Shakespeare's, As you Like It.
 Washington's, Farewell Address.
 Webster's, Bunker Hill Oration.

Macaulay's, Life of Johnson.
 Gray's, Elegy in a Country Churchyard.
 Shakespeare's, Julius Caesar.
 Shakespeare's Midsummer Night's Dream.
 Dickens', David Copperfield.
 Dickens', Tale of Two Cities.
 Mrs. Gaskell's, Cranford.
 Macauley's, Essay on Clive.
 Macauley's, Essay on Warren Hastings.
 Lincoln's, Speeches (selections).

Fourth Year.

Parkman's, Oregon Trail.
 Thoreau's, Walden.
 Huxley's, Autobiography and selections from-----
 Browning's, Poems (selected).
 Tennyson's, Idylls of the King.
 Byron's Childe Harold, Canto IV.
 Byron's, The prisoner of Chillon.
 Palgrave's, Golden Treasury (selections).
 Milton's, L'Allegro, Il Penseroso, and Comus.
 Carlyle's, Essay on Burns.
 Burke's, Speech on Conciliation with America.
 Shakespeare's, Macbeth.
 Shakespeare's, Twelfth Night.
 Shakespeare's, Henry the Fifth.
 Eliot's, Silas Marner.
 Thackeray's, Henry Esmond.
 Thackeray's, English Humorists.

HISTORY.

By DR. GEORGE PETRIE.

I believe that we teachers of history meet with more to perplex us than do any other members of our profession. I do not refer to any lack of encouragement either by the school authorities or by the public at large. Both are helping us greatly. Nor can I here discuss those difficulties that so often come from the teacher's own inadequate knowledge of the subject—a weakness which we all feel in proportion to our candor. I refer solely to classroom troubles, to what are sometimes called pedagogical troubles, to what the business man would call transportation troubles—troubles in transporting what historical goods we have from the source of supply into the pupil.

How familiar is the old complaint, "I have been over this lesson three times, and I can't learn it." And then comes the desperate summing up of the whole matter, "I never did like history anyhow: can't I drop it?" Every honest teacher recalls his own experience as a student, the bewildering names, the multitudinous dates, the terrible remoteness of the whole business. A country boy in a large city is more at home than a beginner in his first ten pages of real history. He does not know what to do with it, and often we teachers are scarcely less helpless. Latin prose, he understands, is to be translated so as to make sense, and mathematical problems are to be worked so as to get the answer, but what is to be done with the history lesson?

The Three Foundation Stones.

1. *Definiteness.*—First of all, it seems to me, the teacher should make clear just what is required in the preparation of the lesson assigned. The pupil can not commit ten pages to memory, even if it were desirable for him to do so; nor can he in his ignorance guess what an experienced teacher will

regard as important. Of course it is not an easy matter for the teacher to select the important things. Experts do not always agree in their judgment about them. A wise choice will depend largely on the training, the scholarship, and the native sense of the teacher. With these I am not at present concerned. What I do insist on is that the pupil should know in advance with some definiteness what his own teacher considers important in the lesson he has to prepare.

I have myself found it helpful sometimes to give in advance questions on the lesson. These may be dictated to the class, or they may be mimeographed cheaply, or, if the class be small, a few carbon pencil-written or type-written copies may be put where the pupils can consult them. The preparation of these will soon become interesting, and the old style, lazy question, "What does the book say about Xerxes?" will give place to some helpful, thought-provoking question that sends the reader back to the book with a definite thing to look for. Indeed, the class may in time be trained to make its own questions, first upon a given page or paragraph and later upon an entire lesson. Competition may be encouraged by selecting for class use the best questions on each page. The discussion as to which are the best will give life to the work and will encourage independence of thought. I have found it a good plan also to include questions that involve a comparison with what has gone before, for example to ask for the difference between the reforms brought about by the Roman Decemvirs and those made by the Greek, Solon. This kills two birds with one stone: it clinches the old while it fastens the new.

When questions can not be given, the teacher can at least go over the lesson in advance with the class, pointing out the things to be remembered in each paragraph, and making the pupils check them on the margin; the leading names and dates can be underscored, and the strange names pronounced repeatedly so as to fasten them in the memory by the ear as well as by the eye.

2. *Thoroughness.*—The second foundation stone upon which good teaching rests is thoroughness. After the teacher determines and explains just what is expected of the class, he should see to it that this is done and is done thoroughly. This

does not mean necessarily that the strong arm of discipline must be invoked; but it does mean drill, drill, drill—an exercise that is too often neglected by us modern teachers, but which is as necessary in order to keep up the morale of the class as it for a maintenance of the efficiency of a military company. Nothing discourages a pupil more than to find that what was worked out with care and labor yesterday is gone today; nothing encourages him more than to find that what is once done remains a permanent acquisition and that there is a steadily growing bank account. Drilling is not only useful, it is a lively and amusing exercise under the guidance of a teacher who knows well what he is drilling on, so that there is no hesitation, or referring to the book for facts. Every teacher can work out his own devices to facilitate the process. I will suggest one or two.

Lists of men and places may be written in a large and clear hand and hung on the wall, where they can be easily seen. Every day these can be run over, some pointed question being asked about each. The same plan can be used for important dates. As the class becomes more familiar with men and events, it becomes an interesting exercise to connect two men or events by some intermediate link, as for example Sulla and Cicero through Pompey, or the history of Gaul with that of Rome through Caesar. Sometimes it proves useful to assign a brief topic for review along with the new lesson, especially if it be short and simple. After the main points have been brought out by the daily lessons, many minor ones can be taken up one by one in the brief reviews. These may be assigned one or two at a time as search questions to be hunted up in the textbook during ten minutes of the recitation period. The change of occupation and the fascination of the chase will often steady a restless class.

3. *Variety*.—The third point that I insist on is variety. These three things, definiteness, thoroughness, and variety are the three foundation stones upon which good teaching of history in our high schools must rest. Of these variety is the one which is most likely to be neglected by an earnest teacher. He should remember that water dropping steadily in one place

wear away a stone, and that monotonous teaching will in time destroy the power of attention of even the most thoroughly disciplined class. Young people especially find it hard to keep either the mind or the body long in one attitude. Restless feet often indicate that the mind too needs a change of position. Skillful teaching is like good conversation; it shifts the topic, the method, the manner, as signs of weariness or of waning interest appear. The object is not, as in the art of war, to keep the attack steadily on the weak point in the opponent's line; on the contrary, the chief purpose should be to avoid the weary spots and to call out constantly some new and fresh faculty while the others recuperate. In this art all of us fall short of what is desirable; but we can improve by practice, as a hostess improves in the art of directing a dinner party so that each person contributes the best that he has, yet none is wearied. No systematic directions can be given, but a few suggestions may be helpful.

The first one is a caution based on my own bitter experience first as a pupil and later as a teacher. It is this: Do not talk a class to sleep or into open rebellion. There are very few men or women who can talk as interestingly to others as to themselves. This is partly because of human vanity, and partly because the thought that we have in mind is usually so much better than the clumsy way in which we express it. We, the talkers, get the former, and enjoy it; the class gets the latter, and is bored. Especially in high school work there is little need for anything like formal lecturing. Yet it is a notable fact that teachers easily drop into a habit of high pitched, continuous talking that either sets the class by the ears or puts it to sleep. In no subject should teaching thus become a process of hammering; in history least of all. Because of its naturally complex character, it is no more to be treated in that way than is a spider's web or a fine piece of machinery. The history teacher might well take a lesson from the mother bird, who, when she has food for the young one, encourages him to do the talking. It opens him up for the food. The business of the teacher is to draw out the pupil, rather than to thrust in the facts; to find out and to explain his difficulties, rather

than to dwell monotonously on the obvious. No pupil is bored while his own trouble is being explained, and half of the battle in teaching history lies in finding out what the pupil's difficulties are, for often he himself scarcely knows. Success in this depends, not on lecturing at him, but on studying his case.

"But," some one will say, "how can you study the individual needs when the classes are so large?" In reply I would say that I have no remedy to offer for large classes. They are the pride and the bane of the teacher's existence. But in my own case I find that the evil can be ameliorated by personal conferences with small groups outside the classroom. I have found this especially helpful with the backward members. It encourages and stimulates them, and it helps me to get a better idea of their need and to adapt my classroom work to them. As soon as they find that the purpose of the conference is not to blame them, but to help them, they state their historical troubles with a freedom that almost swamps one. I think that getting at the difficulties of the pupils is the most important part of our work, as diagnosis is, in that of the physician. Of course no teacher can appeal to the individual wants of every pupil all the time; but this very fact gives him additional reason for varying the program during the hour. Not only do they all collectively get a refreshing change of mental attitude, but each one is more likely to find something that appeals especially to him.

It is well for the teacher to experiment in making out a program for the hour. Something like the following might be tried:

Review the wall list of names.

Mark important things in the lesson for next time.

Dictate a dozen questions on it that require some search, but are not too vague.

Review the wall list of dates.

Question on the most important things in the lesson for the day.

Ask for and propose difficulties.

Explain these briefly and clearly.

Give five minutes for the review of some topic.

Question about it.

This list is, of course, only a suggestion. It will be too long if the teacher is slow or the period is short. It may be varied greatly from time to time; but for any particular day the teacher should know just what he is going to do. A little experience will indicate what items are most effective for each teacher and for each class, and what order gives the best results. These may seem to be small things, but success in teaching, as in other arts, depends on attention to details.

These are in my opinion the fundamental requisites for all good teaching of history. When a teacher has mastered these, he can turn his attention to the higher side of his art; and this brings me to the consideration of

Inspiration in the Classroom.

We all agree that good teaching should be inspiring, and any student is to be pitied who has not at some time in his life come in contact with a teacher who was to him a great inspiration. Such men are born, not made. But after all, this inspiring influence is a thing that exists in many different degrees, and many of us who are not destined to become great teachers of history in the sense that Herbert B. Adams was, can nevertheless with care and labor do far more than we think possible to stir in the young some enthusiasm for a study whose fascination we have felt. Indeed it is encouraging to reflect that this fascination lies in the subject after all and only indirectly in the teacher, and that to a bright pupil the charm of a great subject appeals almost of itself. The point for us is not that we should ourselves be charming while we teach history, but that we should in as many ways as possible give the pupil an opportunity to come into contact with the natural attractiveness of the subject—or perhaps I should say with its attractions, for they are many, and some appeal to one, some to another. These are the windows of the classroom prison. The shutters are sometimes hard to open and the glass dusty; but occasionally a stirring vision may be discerned through them, and an inspiration caught that leads out into the great world of real history.

1. *The First Window; Chronology*: I am sure that the reader will be surprised when I mention as the first window a line of historical study that is usually considered the most desperately uninteresting of all, the study of dates. What could be drier than dates? Have we not always applauded the historic as well as historical pun that speaks of them as the product of the desert? True; but is the study of tuberculosis less interesting because the disease itself is unpleasant? What if the study of dates should lead to the discovery of a remedy for dates, or at least of something that makes them less virulent and the attack less frequent? Not only is such a remedy possible; it has actually been found, and has long been in use everywhere except in the schoolroom. Ask a farmer the date of a famous storm. He may give you an offhand numerical answer, which probably will not agree with the reply given by his neighbor; but usually he will deliberate a moment and then speak somewhat as follows: "That was when my son John was a baby, because he and Sally were caught out in it and were nearly killed; and John voted for the first time last Fall. It must have been about twenty years ago. Yes, you can count on it; it was about twenty years ago." And the beauty of that plan for getting at dates is that you can count on it. It may not get the date precisely, but it can not miss it far. And what a real sense of time it gives. The period 1890-1910 suggests nothing but a mathematical facts, so dry that it is not inaptly compared to a desert; but think of it as covering the entire time during which a young man is growing from babyhood to manhood, and the whole desert is vivified with his life.

That may be a homely illustration, but the principle behind it is a general and far-reaching one. It is that chronology after all is not a mathematical science, but a study in the relation of events to one another. The dates are useful merely to hold the facts until we can grasp their connection, as the splints on a broken arm are there simply to hold the bones until they grow together. For example, the beginner notes that the date of the Hartford Convention is 1814; but after he has learned to think of it in its proper relation to the War of 1812,

the mathematical tag drops from it and it becomes in his mind, as it was in reality, one of the closing incidents of that war. Its time is thus fastened. Again, John Brown's Raid is at first an isolated incident held in place only by the bare date 1859. But the least familiarity with the events before and after it soon fixes it in the mind as one of the things that led at once to the great war, and its date is unforgettable.

So in the study of any period the beginner starts with a few leading dates, and gradually groups incidents around them. Finally, as the facts assume an orderly position, even those dates become unnecessary, the series becomes self sustaining, and the distance of any event from any other can easily be measured in the mind's eye. Indeed this sense of time-distance is one of the accomplishments that a good historian must cultivate. Without it his sense of proportion will be false, and his judgment of the significance of facts will be unreliable. From this standpoint chronology, or the study of dates, is not a matter of mere memory, but of the highest judgment and of the keenest analysis, because it is concerned not with idle figures, but with the connection of events, their proportion, and their significance. It leads not to a multitudinous diversity of disconnected dates, but to a general and reasonable grasp of the whole.

2. *The Second Window: Geography:* It will not surprise anyone to hear that the second window is the study of geography. The growth of a nation like Rome or England is largely a jumble of words unless it be traced on the map. This is now well understood, and the fact is neglected in teaching not so much from ignorance as from sheer laziness. If any teacher doubts the fascination of maps, let him hang a good one in an accessible spot. He will be surprised to see how the boys study it. They find their homes on it if possible, and then push on with their fingers through the half known regions nearby to the alluring world beyond. With many a boy a good map has been the beginning of a larger life.

But the mere acquisition of geographical knowledge should not be the chief purpose in the study of geography. The bright student can soon be led to interpret its effect on history, and then begins the fascination—I might say the dangerous

fascination—of the study. He discovers that it is not an accident that England has a great navy, or that Switzerland is an independent republic with a federal government, or that Egypt was a monarchy. He begins to realize the historical significance of the Suez canal, and to speculate about the effect of the one building at Panama. Thus he gets a cleaner conception of the meaning of cause and effect in history, and begins to feel the fascinating force of the current in its stream.

3. *The Third Window: Pictures:* The first two windows appeal to the reason; the next two to the imagination. The third window is the use of pictures. If any one doubts their charm, let him go to a general reading room and observe how popular the illustrated periodicals are, or let him consider the success of the moving picture show, or watch the effect of the strong paintings in our galleries on the crowds that gaze upon them. Of all subjects taught history seems to me to lend itself most readily to pictorial treatment. Yet what teacher really utilizes the help that pictures can render? The physics room has its apparatus, the mathematics room now frequently has its wooden reproductions of geometrical figures, and the botany room has artificial flowers that can be taken to pieces; but where is the history room that has on its walls pictures of famous men and women, of historic buildings, or of epoch making incidents? What school room in Alabama has even a copy of the famous picture of the Signing of the Declaration of Independence?

Two good pictures, one of a mediaeval castle and the other of a mediaeval cathedral, will do more to help the youthful mind grasp the two sides of life in that period than pages of cold type. A picture of a Roman road showing its magnificent solidity is the most impressive evidence of the power of that empire; and in looking at pictures of Greek pottery, or sculpture, or architecture many of us have felt something of the emotion described by Keats in his Ode to a Grecian Urn, although we lacked the genius to express it.

There are many places where suitable pictures can be bought for a very small amount. If the money be lacking, a small beginning can be made by requesting the members of the class to bring any cuts from magazines or papers that deal with his-

torical matters. An interesting, if not an artistic, collection can thus be made, the stimulating value of which will soon show itself in a rapid flow of unconventional questions.

4. *The Fourth Window: Stories*: This like the last window opens a vista to the imagination. I suspect that the very suggestion of the name, the window of stories, will call forth two criticisms: one that stories are not history, the other that few teachers can tell them well. I admit the accuracy of both statements, but deny their applicability.

It is true that stories are not history; but they may arouse a lively interest in it, as gazing upon the beauty of the heaven on a summer night is a poor substitute for systematic astronomy, but may lead to the study of it. So a story about Caesar or Napoleon may start an interest in him and lead to a study of his real history. In history, as in life, persons often attract our attention and remain in our memories because of some striking peculiarity which can best be recorded by an anecdote, a story, or an amusing incident.

Nor is it necessary that the teacher should be a good story teller. Anecdotes may be read aloud to the class, or they may be posted on the wall. They can be found in popular biographies, and in many histories, especially in those intended for children. Plutarch's Lives will be found a perfect storehouse for ancient history. If the teacher will keep a scrap-book for usable incidents, it will abundantly repay for the trouble that it costs.

5. *The Fifth Window: Reading*: The last window to which I refer is the window of reading. It would seem the most natural thing in the world that the study of history should lead to a wider reading of historical books; yet we all know that it seldom does. At this junction point on our route for the transportation of knowledge to the pupil, bad connections are the rule, and much freight is lost. The trouble seems to be a double one: first, the problem of selecting such reading as is well adapted to go along with the text book and is neither too hard nor too long and grows directly out of the text so that any interest aroused in the lesson carries the pupil easily into it; second, the difficulty of supplying the books where there are little or no library facilities. Something has been

done to fill this want. For nearly every important field of history there are now accessible good books containing extracts from writers contemporary with the events described. These do not cost much and contain a good deal that is vivid and attractive to a high school pupil. Under the guidance of a skillful teacher they may be used with profit. They have the further advantage of bringing the student into direct contact with the evidence upon which historical judgments rest, and of thus training him to independence of thought. But nothing can take the place of a school library, containing some good history and a liberal supply of readable biographies and books of travel. Our schools are equipping laboratories for physics and chemistry and mechanic arts; they simply must not neglect their libraries or they can not properly teach history.

The Historical Attitude of Mind.

Now in conclusion what should be the ideal toward which the teaching of history should look? I think it can be summed up as the cultivation of an historical attitude of mind. It is often said that this is a scientific age; it is just as truly an historical age. We have, it is true, adopted a critical attitude toward everything and call unceasingly for the evidence; and history, like other branches of research, has become more scientific. But, after all, the most striking characteristic of our time is not so much this critical tendency as it is the growing realization that nothing can be adequately understood save as a growth or development; and thus modern science is assuming more and more the historical standpoint. Under these circumstances surely history would cease to be true to its own mission if it should fail to cultivate the attitude of mind that sees the development of things. To the historian the automobile and the old-fashioned traction engine are the same thing in different stages. To him the modern English parliament is but an outgrowth of the Saxon Witenagemot, and he watches the present struggle over its powers and structure, not as a partisan, but as a philosopher eager to trace its next phase. In human life and in human institutions he learns to observe "first the blade, then the ear, then the full corn in the ear."

MATHEMATICS.

By PROFESSOR J. J. DOSTER.

In times past Mathematics along with the ancient languages constituted the bulk of almost every course of study and required the greater part of the pupil's time and effort. Other subjects were deemed of minor importance and only these made the objects of serious study. In most schools proficiency in mathematics was the chief standard by which the scholarship of a pupil was judged. In recent years, however, owing to the increasing demands of modern life, the curriculum has been greatly broadened by the addition of the modern languages, English, history, the physical sciences and industrial subjects, and because of this, mathematics no longer dominates school-work as it once did. It must now take rank along with other subjects and receive with them its proportionate share of the pupil's time.

Since the enrichment of the high school curriculum by the addition of other subjects has made necessary the cutting down of the time formerly devoted to mathematics, and since it is commonly asserted by educators that in the teaching of no other subject is there such a waste of time and energy as in the teaching of this, it is imperative that good teaching be done in order that the pupil may accomplish the required work in arithmetic, algebra and geometry before finishing the high school course. Results show that the ordinary method of teaching mathematics in both the elementary and high school are stupefying and deadly. The child begins the study of arithmetic usually at the age of seven and continues it for seven or eight years, and is often unable to solve easy problems in fractions, interest or the "rule of three." After "completing" algebra the high school pupil frequently cannot solve the simplest quadratic equations "without looking at the book." Such being the case, it is time for teachers of mathematics to wake up and begin inquiring into the causes of the inefficiency of their pupils and the ineffectiveness of their teaching.

The following books should be in the hands of every teacher :

Young's Teaching of Mathematics in the Secondary School.
(Longmans, Green & Co., New York.)

Smith's Teaching of Elementary Mathematics. (McMillan
Company, Atlanta.)

Ball's Short History of Mathematics. (McMillan Co.)

First Year.

Arithmetic.—Five periods per week during First Half Year.

During this time the pupils are expected to review the fundamental operations of arithmetic and apply the principles mastered in fractions, interest, discount, etc. Thorough proficiency may not be expected here, nor need the pupils be expected to solve all sorts of arithmetical problems. A good working knowledge of the fundamental operations is the aim to be attained; and when this is reached it is time to begin the study of more abstract subjects. Since geometry and algebra deal with principles that find application in arithmetic, it is a waste of time to put off the study of these branches until arithmetic has been mastered. The truth is there can be no clear full appreciation of arithmetic until the subject is illumined by the light which comes from a study of more abstract mathematics.

Algebra.—Five periods per week during Second Half Year.

In making the transition from arithmetic to algebra careful teaching should be done in order to insure on the part of the pupil a clear understanding of the meaning and relations of algebraic terms. At first but little stress should be laid upon definitions, axioms, etc. These will be more readily learned after some progress has already been made. "Make haste slowly" should be the watchword with beginners.

Second Year.

Algebra.—Five periods per week during First Half Year.

This subject is continued from the previous year and extends to quadratics. The equation, clearing of fractions and elimination are topics that need carefully to be stressed. Since

most pupils meet with difficulty in solving problems, it is an excellent plan to approach the study of these by the means of graphical statements. When the elements of a problem are concretely presented by the aid of lines, but little difficulty is experienced in forming equations in the solution. Teachers will find many helpful suggestions in Aley's Graphs, a small pamphlet published by D. C. Heath and Company, Boston, and in the recent high school texts in algebra.

Plane Geometry.—Five periods per week during Second Half Year.

Plane geometry now takes the place of algebra and continues for one year.

The difficulties that a student encounters in beginning geometry are due not so much to the subject itself as to the way it is usually approached. If plunged at once into the subject without previous preparation the student is unable to grasp the meaning of the abstract definitions, or to follow the close sequence of the reasoning process. The proper method of approach for the average pupil is through concrete geometry—the drawing of lines, angles, construction of geometrical figures, and the linear solution of sample problems involving data easily comprehended by the learner—a subject sometimes called geometrical drawing. (See Geometrical Drawing.) If geometrical drawing be taught by the teacher of geometry, it can be made a most effective introduction to this study.

Third Year.

Geometry.—Five periods per week during First Half Year.

The study of plane geometry is continued and completed during the first half of the year. Special attention should be given to the solution of original propositions in order to give pupils independence of thought and to discourage *memoriter* recitations. If taught successfully the following results should be produced:

1. "Familiarity on part of the pupil with the common geometrical figures and the theorems relating to them.
2. Ability to construct such figures accurately with rule and compass.

3. Reasonable appreciation of deductive reasoning and reasonable resourcefulness in applying deduction processes to the solution of exercises of moderate difficulty.

4. Reasonable appreciation of the utility of geometry.

To accomplish the foregoing results:

1. Give the class thorough training in geometrical drawing before beginning geometry proper. During this period of preparation emphasis should be placed on the acquisition of concepts, rather than vigorous proofs.

2. Throughout the course use drawing instruments upon the board and upon paper.

3. Give original exercises daily. Teach general methods of analysis, such as lines may be proved equal by showing them to be homologous parts of equal triangles.

4. Have pupils prepare summaries of facts known about particular figures, e. g., the facts known about isosceles triangles.

5. Much attention should be given to theorems having practical applications. Many exercises should deal with real problems selected from surveying, architecture, design and drawing. (See studies in Secondary Education, which can be had for 30 cents from Teachers College, New York.)

6. Algebraic symbolism and reasoning should be employed freely.

7. Insist upon good form in the presentation of oral and written recitations. Half statements should not be accepted. Insist on the quotation of full theorems as authorities on demonstration.

Algebra.—Five periods per week during Second Half Year.

Advanced algebra is now taken up and continued for one year.

A thorough review should be made of the fundamental operations,—addition, subtraction, multiplication, and division, of factoring, fractions, and eliminations, topics previously studied, before beginning the more difficult parts of the book. Affected quadratics and radicals should be thoroughly taught. The teacher should strive to have the pupils master principles, as well as processes.

Fourth Year.

Algebra.—Five periods per week during First Half Year.

Solid Geometry.—Five periods per week during Second Half Year.

Those students who are expecting to go to college, and others who so desire, may begin and complete solid geometry during the second half of the year. To teach the subject well the teacher should provide himself with suitable models for illustrative purposes. The pupils should be required to construct models of card-board. The practical applications of the subject should be stressed.

Arithmetic.—Five periods per week during Second Half Year.

Instead of solid geometry, if the pupil so desires, advanced arithmetic may be taken up and studied during the remainder of the year. Now is the time for the pupil to get a broad grasp of the subject of arithmetic, for he is able because of his study of algebra and geometry to discover underlying principles and to apply them in the solution of new and untried problems. It is hardly necessary to add that the teacher should deal with the subject in a comprehensive way so as to secure and hold the interest and attention of his advanced grade of students.

PHYSICAL GEOGRAPHY.

By DR. W. F. PROUTY.

In the teaching of any science it is essential first of all to acquaint one's self with the purposes of the course, and with this clearly in mind to search for the best methods of accomplishing the desired results. The purposes of the course should, obviously, be governed by the needs. The first year high school science should follow logically in its make-up after the Nature Study and the Geography of the grades, and it should form a basis for the more advanced and specialized sciences which are to follow, such as Biology, Agriculture, Physics, Chemistry, Physiography, Commercial Geography, etc. It must, then, serve as a finishing course in Regional Geography and also as a very broad and generalized introduction to science and scientific methods.

It is the general opinion among educators that the first year high-school science should be somewhat of the nature of Physical Geography. There is, however, also a rapidly growing conviction that many of the courses at present given under the name of Physical Geography are not at all adapted to this position. This is so largely through the fact that we are fitting too much for college and not enough with a thought for the ninety per cent of students who never go to college. Because of the fact that so few students go on into higher fields of learning, we should make this early science as practical as possible in its bearing, without taking away from its scientific value.

With the above thoughts in view I wish to present very briefly what seems to be the most essential things to keep in mind in connection with the study of this first year high school science.

First and foremost the humanistic standpoint should be the one chosen in our study of the changes and character of the earth's surface. How is man related to this or that change or

process, how limited, how assisted? By this method of study we not only record the phenomenon but see its practical significance.

Secondly, we do not as a rule pay enough attention to the regional geography of the countries studied and I would emphasize the necessity of our giving greater thought to this phase, especially concerning our own country and Europe. A most excellent method of doing this is by employing the physiographic division as a unit of study, since the conditions affecting man's activities are more uniform over such provinces than over provinces as ordinarily grouped by states. For instance the Piedmont regions are sharply defined from the Coastal Plain regions. The effects which these two areas have upon mankind are entirely distinct.

Thirdly some kind of laboratory or field work in which the student is made to observe for himself and record the phenomena, is absolutely essential to a good course in this early science.

We will find if we apply the above principles, that certain subjects often taught in the early science course, should be less emphasized than is ordinarily done, and that they should be left to a later and more advanced text on Physical Geography or Physiography. For instance in the study of the relations of earth and the solar system we should consider essential such things as standard time, changes of seasons, the international date line, etc., but as much less so, facts relating to the size of sun and planets and their periods of rotation and revolution. The study of the ocean as a modifier of climate, a destroying and constructing agent in land forms etc., should be emphasized rather than ocean depth and temperature. In the study of the lands we wish to know the processes by which the lands are changing their forms, and the topography being modified, so that the relations of climate and man to the area are in consequence being altered. We should not concern ourselves, however, with systematic classification of these various land forms at this time.

The laboratory and field work should occupy one fourth of the time of the course and the work should be recorded in neatly kept note books of uniform size.

Laboratory and Field Work.

The subjects as outlined below are not complete but are intended as suggestions to aid the teacher in choosing those subjects for laboratory and field work which seem to the author best adapted to be studied during the first year high-school science course. As ordinarily outlined, the work in Physical Geography is treated under five general headings as follows:

1. The Planet Earth.
2. The Lands.
3. The Ocean.
4. The Atmosphere.
5. The Life of the Earth.

The above order of presentation of the subjects is not always followed, nor is it always best. Especially is this true for our part of the country where we can do field work conveniently throughout the greater part of the winter. Therefore in our southland the chapter on the Atmosphere should come next after the study of the Earth as a planet. This is done so that the observations of the weather may be continued throughout the year. The field and laboratory work in connection with the study of the Land and the Atmosphere should occupy at least three quarters of the total amount, as these two subjects are of such economic and vital interest to the everyday life of the student.

Planet Earth.

Under the subject of the "Planet Earth" two instructive and interesting exercises should be done:

1. By mean of a perpendicular stake three or four feet high, set in level ground, and the shadow cast by it from the sun, determine: a. The north and south line, told by the direction of the shortest shadow cast during the day. b. Solar noon or true noon, told by the time when the shadow is the shortest or in other words the sun is the highest in the heavens.

c. The latitude of the place of observation in degrees, which is equal to the complement of the angle of the sun's elevation above the horizon at solar noon minus or plus the amount of the sun's angular distance south or north of the Equator respectively.

2. By observations of sun's mid-day or maximum altitude, taken at weekly intervals, determine whether the sun is traveling northward or southward and at what rate in degrees per day.

Atmosphere.

1. With the beginning of the study of the atmosphere, have a continuous daily record kept of the temperature, general direction and velocity of wind, amount of precipitation, character of clouds, etc. Keep up these observations throughout the year. Let each student make the observations for a week at a time. Compare the results with the weather map issued by the nearest Weather Bureau station. These maps can be had free upon application to the Chief of the Weather Bureau at Washington.

2. Study carefully in laboratory the daily weather maps of the Weather Bureau.

3. Construct weather maps from data taken from a well developed high and low area weather map of the Weather Bureau, upon blank maps which are used by the Weather Bureau for this purpose and which can be gotten from the nearest station of that Bureau, usually free of charge.

4. Make rainfall maps of the U. S. and explain the difference in the amounts of precipitation in the different areas. Do the same for the different continents.

The Lands.

1. In connection with study of the lands and subsequently in the course, encourage the students to make collections of rocks, minerals and all kinds of natural history specimens. This is one of the best ways of arousing and sustaining the students' interest in scientific work.

2. Study a few of the more common rock-forming minerals, some fifteen to twenty in number, get familiar with their color, hardness, cleavage, etc.

3. Study the more common rocks, notice how they are put together, of what kind of minerals they are formed. Neat and compact sets of well labeled and described minerals and rocks can be had very cheaply from laboratory supply houses. (See list of such houses at end of article.)

4. Study rocks and minerals in the field and notice their processes of weathering and their decomposition products.

5. The study of the soils should have much attention in this early course and the following characteristics should be noted: size, smoothness, and mineral composition of grains; amount of air space; consistency while wet and after drying; permeability; ease of working. Consider each type from the agricultural standpoint and estimate if possible, by plant growth, the relative importance of each in respect to certain plants. This may be best ascertained by taking notes relative to the vegetation in the field from which the soil came. Note also whether the soil that you have has been transported by the streams or whether it is taken from above the rock from which it was derived.

6. Study topographic maps. Construct a topographic map from blank map having the elevations of a sufficient number of places noted upon it. Also make profiles (elevations) from these topographic maps.

7. Make careful study of the different phases of stream erosion and deposition, either from observations on some nearby branch, river, or gully, or by observation upon some artificially formed stream in the school yard or laboratory table. Make use of different mixtures of sand and gravel, sand and clay, gravel and clay and sprinkle with hose or pot. The miniature erosion forms can always be advantageously studied even if the real streams are accessible, because with a little ingenuity on the part of the teacher in the arrangement of the sands etc., and the correct placing of obstructions as pebbles and chips of wood, all the phases of stream erosion from wa-

ter-falls to meanders can be most clearly brought out, together with the many phases of sedimentation in the different kinds of materials used, in the space of a few feet.

8. Make a map of the Physiographic regions of the United States and study each of the regions by means of a representative topographic map.*

9. Make a large scale map of the area immediately surrounding the school. Use compass for directions and pace for distances. Put in topographic lines, using the most convenient contour interval for the nature and ground mapped.

10. In connection with the special study of the United States and Europe make a map of each showing its drainage basins.

The Ocean.

1. On blank outline map of the world (Mercator projection) draw the chief ocean currents and streams. Compare an isothermal chart of the world with the map of ocean currents and note the effects of the warm and cold streams in the modification of the climate in the temperate zones. England and Southern Labrador have about the same latitude.

The Meeting of Land and Sea.

This is of much more interest to the student than the study of the ocean and should take up more of the laboratory as well as the recitation time than the former.

1. If possible have some good models of the shore lines representing at least two conditions: the one of the advancing sea and the other of the advancing land. The three Harvard Geographical models are most excellent for this study.

2. Study carefully some of the topographic sheets of the United States Geological Survey. Contrast some from the coast of Maine with some from the coast of New Jersey and the Carolinas. Give attention to the different kinds of har-

*Use as a basis of this study Monograph on "Physiographic Regions of U. S." American Book Co.

bors of the United States and explain their relative importance.

New York—A drowned valley harbor.

Boston—A moraine harbor.

New Orleans—A river harbor.

Galveston—A bar formed harbor.

Equipment.

Geography cannot be learned satisfactorily without suitable material and appliances any better than can Physics or Chemistry. This fact should be brought to the notice of the school board and an appropriation should be had for fitting up a room in a suitable manner for the study of this early science. All the equipment for this course can be made use of also by students in the more advanced courses in either Physiography or Commercial Geography. The extra equipment for the more advanced courses in either Physiography or Commercial Geography. The extra equipment for the more advanced courses should consist mainly in a larger number of atlases and topographic maps. The list of essentials in laboratory equipment will differ with varied localities and under different conditions, so that one cannot make any very definite statement as to what the schools as a whole should or should not have. A great deal depends upon the ingenuity of the teacher to use one thing for many purposes. I do wish, however, to suggest the desirability of a number of pieces of apparatus, of certain collections, and of certain books, charts, etc. Every high school teaching this early science should have at least the equipment which is starred (*) in the following list:

| | | |
|---------|---|---------|
| Globes. | 1. *A good 12in. spherical globe of the world ----- | \$ 3 30 |
| | 2. A large flat globe of the world (27in.) International Globe Co., N. Y.--- | 2 00 |
| Models. | 3. Harvard Geographical Models three in number -- ----- | 20 00 |
| | 4. Howells set of five models of the continents -- ----- | 150 00 |

Maps.

Large scale maps for the wall and table are indispensable for class-room and laboratory, and can be had at small cost.†

5. *Maps of the Mississippi River large-scale, 5 miles to the inch, eight maps -- ----- 1 00
6. Maps of Lower Mississippi River scale 1 in.-1 mile, 32 sheets----- 1 60
For the Mississippi River maps address Mississippi River Commission, St. Louis, Mo.
7. *U. S. topographic maps. These are very useful and can be had, if as many as a hundred are ordered, at 3 cents each. Consult pamphlet list to determine maps wanted for study.† It would be well to get enough of each of at least three sheets to go around the class, and also one each of a large number of sheets, illustrating a large number of subjects, as for example: Dissected Plains, Flood Plains, Glacial Lakes, etc., etc.
8. *Folios Nos. 1 and 2 of United States Geological Survey, illustrating Physiographic Types at 25 cents -- ----- 50
9. Pictures. A collection made from magazines, railroad advertisements, etc., is most excellent. A few uniform sets can be purchased which are to be recommended.

- | | | |
|-----|--|------|
| a. | *Scenes from every land, 500 photographs, J. W. Jones, Springfield, Ohio -- -- -- | 5 00 |
| b. | America photographed, 210 views, Donahue and Hennebry, Chicago | 1 00 |
| c. | *Our own country, 500 pictures with descriptive text. The National Co., St. Louis, Mo.----- | 3 50 |
| 10. | Lantern slides can be had from the different scientific supply houses at a rate of about 35c per slide. (See list of supply houses at end of article). | |
| 11. | *Large chart illustrating isotherm, isobars of world for January, July and the year, also large chart showing circulation of atmosphere. | |
| 12. | *Blank maps of various sizes and kinds. | |

General Apparatus.

- | | | |
|-----|--|----------|
| 13. | *Compass -- -- -- | 3 00 up. |
| 14. | *Barometer -- -- -- | 5 00 up. |
| 15. | *Thermometer -- -- -- | 1 00 up. |
| 16. | Reading glass 2in. to 3in. diameter. | |
| 17. | Small pocket lenses for individual students. Have each student buy one if possible -----15c | 1 00 |
| 18. | *Good sized protractor, celluloid will do. Inexpensive paper protractors for each student would also be advantageous.----- | 75 |
| 19. | *Weather-vane of good length and easy bearing placed above houses and trees, so as to register true direction of wind. | |

- | | | |
|-----|---|---------------|
| 20. | *Rain-gauge, Weather Bureau standard -- -- ----- | 1 25 |
| 21. | Stereopticon lantern ----- | 35 00 up. |
| 22. | *Some dilute hydrochloric acid for testing rocks and soils. | |
| 23. | *A few test tubes. | |
| 24. | *A number of pint Mason jars for the study of soils. | |
| 25. | *Tables, suitable for map work for students. | |
| 26. | *Cabinets suitable for holding maps, charts, models, and various col- lections. | |

Collections.

27. *Rock collection of at least twenty of the more common species.
28. *Mineral collection of at least twenty of the more common species.
29. Collection of the typical soils of the locality.
30. Various other collections such as grains, economical and useful plants, fibres, woods, shells, insects.

Reference Books.

The teacher of physical Geography should be familiar with its literature, or he should at least be able to turn quickly to important lists of Bibliography of the subject.

For lists of literature bearing upon the subject consult the appendices of some of the standard texts in Physical Geography. The lists found in Davis's, Dryer's, Tarr's Physical Geographies among others, are most excellent. Also consult "Hints to Teachers and Students on the Choice of Geographical Books." Mill, \$1.25, Longman, Green & Co.

For general reference the Annual Reports, Monographs, Professional Papers and Bulletins of the United States Geological Survey, and the various State Geological and Natural History Surveys; publications of the United States and State Departments of Agriculture, the United States Weather Bureau, and the Smithsonian Institute of Washington, are very valuable and may be had as a rule for the asking. Send to each of the above Bureaus for lists of their publications from which to select literature.

Periodicals.

It is very essential that the teacher of a subject which is so rapidly developing as the first year high-school science, should have access to the most up-to-date periodicals. The interest and value of the geographical study to the student will also be very much enhanced by the reading of geographical magazines and journals.

Out of a large list of periodicals the following are chosen as most desirable for the school library:

1. *Journal of School Geography, Lancaster, Pa.---\$1 00
2. *National Geographic Magazine, Washington,
D. C. -- ----- 2 50
3. Bulletin of American Geographical Society, New
York -- -- ----- 4 00
4. Geographical Journal, London, England----- 6 00

The Journal of School Geography is more especially adapted for the teacher than the student and should as far as possible be in the hands of every one teaching this science. The National Geographic Magazine is perhaps for the price the best periodical for the students, as it is very broad in its scope and profusely illustrated.

Supply Houses.

There are a number of houses which supply equipment of one kind or another for the Physical Geography laboratory, among these the following should be mentioned:

1. Central Scientific Society, Chicago, Ill., furnishing all kinds of Physical Geography supplies.
2. Foote Mineral Co., Philadelphia, Pa., furnishing rocks, minerals, and all kinds of cabinets.
3. Wards Natural History Society, Rochester, N. Y., furnishing models, restorations, and collections.
4. Keystone View Co., St. Louis, Mo., furnishing lantern slides, stereopticon views, pictures, etc.

The members of the Departments of Geology and Biology of the University of Alabama, together with the officers of the State Natural History Museum at the University, are anxious to co-operate with the high schools of the State in establishing at each school such collections of minerals, animals, plants, etc., as may best develop the interest of the students in the science of Natural History. To this end a small collection of most attractive sea-shells, well labeled and described, is offered free to each of those high schools of the State which will agree to put this collection on exhibition in a well lighted and attractive place and also provide room for other collections which they will encourage the students to make. The identification of all specimens sent to the University for that purpose will gladly be made, as far as possible.

Please direct communications concerning collections and send all specimens for determination to the State Geologist, University, Alabama. The State Museum would also be glad to make exchanges with any of the high schools of the State for duplicate material which they may have or can gather.

BIOLOGY.

By PROFESSOR F. E. LLOYD.

Biology includes the two subsidiary subjects, Botany and Zoology. While a course in biology, meaning a study of animals and plants taken together, offers some advantages; it has been found that, for the high school, the separate treatment of the sub-divisions, is on the whole more feasible. For this reason outlines for these courses are given separately. It is contemplated that the time shall be divided equally, botany taking one-half of the year, and zoology the other half.

The order in which they should be taken is a question which may best be decided by the teacher. Insects, with which the course in zoology is begun, are very plentiful when school opens in the fall, and this is a very good reason for starting the course at this time. Spring is correspondingly the more natural time for the work with plants, though there is plenty of material at all times, in Alabama.

The text-book for use in Botany is Bergen's Elements of Botany, and this will be found to cover satisfactorily the ground indicated in the outline, the purpose of which is primarily to indicate the most important subjects to be considered.

Botany.

The following outline of a course of botany for the High School is one which has been worked out by a Committee on a Standard Course in Elementary Botany, appointed by the Botanical Society of America.*

This standard course may therefore be taken as representing to a close degree of approximation the general scope of a good elementary course in botany for the high school, being recognized by the botanical teachers throughout the country as embodying a concensus of opinion which is practically unanimous.

It is not the purpose that such an outline be rigidly followed. It may very well be understood that at the present moment, in Alabama, it may be difficult to live up entirely to the standard set, but it will very properly be regarded as a desirable ideal toward which to work. It may be emphasized that it is more important to do well so much as it proves feasible to do, than to try to cover the whole outline in a poor fashion.

Order of topics. The order of topics followed under the sub-head A and B, Part I is generally considered quite as good if not better than any other for an introductory course, but, here again it is not intended that it must be adhered to. It is, furthermore not contemplated that these parts should be treated separately. Indeed, it is understood that the better plan is to associate the topics of B, part 1, with those of A, part 1, at the time when the material lends itself best for the particular purpose. By comparing the outline with the matter presented in any of the better elementary text for high school use, one may readily decide how this association of the topics in question may be brought about.

But it may further be noted that either Part I or Part II may precede the other, so that, if one prefers, the course may be begun by a study of types of plants. This, while adopted by many teachers, is, we believe not the better, as it is less adaptable to young students. Furthermore it is not so easy to correlate the work with that in elementary agriculture, and this, we take it, is highly important. The course in botany, while intended as such, can and should be made to be as practical as possible. That is to say, it ought to give the pupil training and information in the fundamental facts about the life histories and physiological processes in plants, all of which underlie the successful modern development of agriculture in the widest sense. The contact of botany with other modern activities, including manufacture, health (public and private hygiene) and the conservation of natural resources by forestry methods, should be indicated as fully as possible, so that our public school pupils may be led to see not only the general and

special importance of botany in modern life, but to appreciate the opportunities it offers for life work. The increasing demand for skilled botanists in the management of private enterprises depending upon specialized forms of agriculture, for scientifically trained men who can help to solve problems of the manufactures, the awakening to the duty of the public toward hygiene, and the consequent demand for health officers; the growing demand for foresters in every state; the increasing responsibilities of parents in the proper training of their children as regards the fundamental facts of life, including the matter of personal cleanliness in the bacteriological sense, and the responsibilities attaching to the individual in this regard; all these are fundamental reasons for the proper use of botany and zoology in the school. The general acceptance of the truth of this claim puts the responsibility definitely upon teachers of the biological sciences in the schools, and botany must properly bear its share in the task.

The teacher should keep constantly in mind the fundamental principle of good botany teaching, namely, to lay stress at all times upon the importance of the method of botany. For this reason the experimental aspect of the science is above all important. No good teacher will be satisfied with anything short of the completely logical, if otherwise incomplete, proof or argument. The good, more than anything else, which science has done, is to develop a method of thought, or, if you wish, a method of study. The essence of this is the demand for adequate proof, and for the refinement of the methods of research by which this may be obtained. Teachers who have not had opportunities for special study in this direction, should give themselves the opportunity by the study of the books mentioned in the list below, mentioned roughly in the order of immediate importance.

Outline.

Specifications of the Topics to be Studied:

PART I. THE GENERAL PRINCIPLES OF (A) ANATOMY AND MORPHOLOGY, (B) PHYSIOLOGY AND ECOLOGY.

A. Anatomy and Morphology.

The Seed. Four types (dicotyledon without and with endosperm, a monocotyledon and a gymnosperm); structure and homologous parts. Food supply; experimental determination of its nature and value. Phenomena of germination and growth of embryo into a seedling (including bursting from the seed, assumption of position and unfolding of parts).

Note: Much may be said in favor of beginning this part of the work by a comparative study of the fruit, rather than the seed. By this means the pupil better understands the nature of the "grain" of corn.

The Shoot. Gross anatomy of a typical shoot; including the relationship of position of leaf, stem (and root), the arrangement of leaves and buds on the stem, and deviations (through light adjustment, etc.), from symmetry. Buds, and the mode of origin of new leaf and stem; winter buds in particular. Specialized and metamorphosed shoots (stems and leaves). General structure and distribution of the leading tissues of shoot; annual growth; shedding of bark and leaves.

The Root. Gross anatomy of a typical root; position and origin of secondary roots; hair-zone, cap and growing-point. Specialized and metamorphosed roots. General structure and distribution of the leading tissues of the root.

The Flower. Structure of a typical flower, especially of ovule and pollen; functions of the parts. Comparative morphological study of four or more different marked types, with the construction of transverse and longitudinal diagrams.

The Fruit. Structure of a typical fruit. Comparative morphological study of four or more marked types with diagrams.

This comparative morphological study of flowers and fruits may advantageously be postponed to the end of II- and then taken up in connection with classification of the Angiosperms.

The Cell. Cytoplasm, nucleus, sap-cavity, wall.

As to the study of the cell, it is by no means to be postponed for consideration by itself after the other topics, as its position in the above outline may seem to imply, but it is to be brought in earlier along with the study of the shoot or root, and continued from topic to topic. Although enough study of the individual cell is to be made to give an idea of its structure (a study which may very advantageously be associated with the physiological topics mentioned first under B), the principal microscopical work should consist in the recognition and study of the distribution of the leading tissues.

B. Physiology and Ecology.

Role of water in the plant; *absorption* (osmosis), *path of transfer*, *transpiration*, *turgidity and its mechanical value*, *plasmolysis*.

Photosynthesis; *dependence of starch formation upon chlorophyll*, *light and carbon dioxide*; *evolution of oxygen*, observation of starch grains.

Respiration; *need of oxygen in growth*, *evolution of carbon dioxide*.

Digestion; *digestion of starch with diastase*, and its role in translocation of foods.

Irritability; *geotropism*, *heliotropism* and hydrotropism.

Growth; *localization in higher plants*; amount in elongating stems; relationships to temperature.

Fertilization: *sexual and vegetative reproduction*.

Although for convenience of reference, the physiological topics are here grouped together, they should by no means be studied by themselves and apart from anatomy and morphology. On the contrary, they should be taken up along with the study of the structures in which the processes occur, and which they help to explain; thus, photosynthesis should be studied with the leaf, as should

also transpiration, while digestion may best come with germination, osmotic absorption with the root, and so on. The student should either try, or at least aid in trying, experiments to demonstrate the fundamental processes indicated above.

Modifications (metamorphoses) of parts for special functions.

Dissemination. Cross-pollination.

Light relations of green tissues; leaf mosaics.

Special habitats; Mesophytes, Hydrophytes, Halophytes, Xerophytes; Climbers, Epiphytes, Parasites (and Saprophytes), Insectivora.

The topics in ecology (particularly the first four and in part the fifth), like those in physiology, are to be studied not by themselves, but along with the structures with which they are most closely associated, as cross-pollination with the flower, dissemination with the seed, etc. The fifth may most advantageously be studied with G. in Part II.

In this connection field-work is of great importance, and, for some topics, indispensable, though much may be done with potted plants in green-houses, photographs, and museum specimens. It is strongly recommended that some systematic field-work be considered as far as it goes with the laboratory work. The temptations to haziness and guessing in ecology must be combated.

Part II. The Natural History of the Plant Groups, and Classification.

A comprehensive summary of the great natural groups of plants, based upon the thorough study of the structure, reproduction, and adaptations to habitat of one or two types from each group, supplemented and extended by more rapid study of other forms in those groups. Where living material is wanting for the later, preserved material and even good pictures may be used, and a standard text-book should be thoroughly read. The general homologies from group to group should be understood, though it is not expected that these will be known in detail.

In general, in this part of the course, it is recommended that much less attention be given to the lower and inconspicuous groups, and progressively more to the higher and conspicuous forms.

Following is a list of recommended types from which, or their equivalents, selection may be made:

A. Algae. *Pleurococcus* (forming a green incrustation on the bark of trees). *Sphaerella* (a common plant producing a red color in rocky pools and streams in early spring). *Spirogyra* (the common green water-silk seen in ponds in spring and fall). *Vaucheria*, *Fucus*, *Nemalion* (or *Polysiphonia* or *Coleochaete*).

B. Fungi. *Bacteria*,* *Rhizopus* or *Mucor* and *Penicillium*, (the common black and blue moulds of the pantry). Yeast, *Puccinia* (wheat or oat rust or a powdery mildew, Cedar-Apple rust,) Corn Smut, Mushroom or Toadstoll.

Bacteria and yeast have obvious disadvantages in such a course, but their great economic prominence justifies their introduction

C. Lichens. Any of the very common kind occurring on tree-trunks, rocks, etc.

D. Bryophytes. In *Hepaticae* (Liverworts,) *Radula* (or *Porella* or *Marchantia*). In *Musci*, *Minium* (or *Palytrichum* or (*Furaria*.)

E. Pteridophytes. In Filicineae (ferns), *Aspidium* or equivalent, including, of course, the prothallus.

*See below for special outline.

In Equisetineae, *Equisetum* (Horse-tail or scouring rush).

In Locopodineae, *Lycopodium*, and *Selaginella* (a common kind is found abundantly along streams in moist woods, or Isotes).

F. Gymnosperms. Pine; cedar (the cedar-apple should be explained).

G. Angiosperms. A monocotyledon and a dicotyledon, to be studied with reference to the homologies of their parts with those in the above groups; together with representative plants of the leading subdivisions and principal families of Angiosperms.

Classification should include a study of the primary subdivisions of the above groups, based on the comparison of the types with other living (preferably) or preserved material. The principal subdivisions of the Angiosperms, grouped on the Engler and Prantl system, should be understood.

The ability to use manuals for the determination of the species of flowering plants is not considered essential in this course, though it is most desirable. It should not be introduced to the exclusion of any part of the course, but should be made voluntary work for those showing a taste for it. It should not be limited to learning names of plants, but should be made a study in the plan of classification as well.

The preparation of an herbarium is not required nor recommended except as voluntary work for those with a taste for collecting. If made, it should not represent so much a simple accumulation of species as some distinct idea of plant associations, or of morphology or of representation of the groups, etc.

A Brief Outline for the Study of Bacteria.

Some practical knowledge of bacteria in their relations to public and individual health alone, aside from other considerations, is of such paramount importance that the suggestions

given below should be included in the course in botany, unless they are provided for in other courses, namely, in human physiology or zoology.

Bacteria. General character, using pictures and descriptions supplemented, if possible, with microscopic demonstrations of stained preparations, obtainable from dealers. **Your Health Officer would probably be glad, to supply you with a few such microscopic preparations, for this purpose. If you show definite interest, he will doubtless show you how to carry out a few fundamental operations such as sterilization, etc.

Useful bacteria: nodules in legumes and their importance to the farmer, and so to humanity. Other useful bacteria.

Harmful bacteria: animal, including human, diseases caused by bacteria; plant diseases similarly caused.

Sterilization of preserved foods (and of gelatine culture media).

Growth of (non-pathogenic) bacteria in gelatin or agar plate cultures of bacteria found in the air of the laboratory. Disinfection of a room.

Methods of infection: from the hand to a gelatine plate, from an insect (house-fly) to a gelatine plate.

Spread of disease by infection by the agency of public utensils, such as the school or train drinking cup. How to defend one's self against such infection.

Books.

Books are a very great help, if rightly used. The most useful books on Botany are those which stimulate to inquiry. Among many which might be mentioned the following short list is given:

Bergen, J. Y., *The foundations of Botany*. New York: Ginn & Co.

Bergen and Davis, *The Elements of Botany*. New York: Ginn & Co.

Coulter, J. M., *Plant Relations*. New York: D. C. Appleton & Co. \$1.10.

- Coulter, J. M., Plant Structures. New York: D. C. Appleton & Co. \$1.20
- Ganong, W. F., The Teaching Botanist. New York: The MacMillan Co.
- *Ganong, W. F., Plant Physiology. New York: H. Hall & Co.
- *Lloyd, F. E., and Bigelow, M. A., The Teaching of Biology in the Secondary School. Longman, Green & Co., New York. \$1.50.
- *Strasburger, Noll, Shenck and Karsten. 3rd. English Ed., New York: The MacMillan Co.
- Strasburger's Practical Botany, New York: The MacMillan Co.
- Osterhout, W. J. V., Experiments with Plants. New York: MacMillan Co. \$1.50.
- Hills Bacteria in Everyday life.
- Coun. Bacteria; Yeasts and moulds in the Home. Blakiston Sons.
- Bailey, L. H., Plant Breeding. New York: The MacMillan Co.

Materials and Apparatus.

CHEMICALS.

Chrome alum. A one per cent. solution is an excellent preservative of flowers for later dissection. They can be put up in quantities in ordinary Mason jars, but when studied they must be dissected in a saucer under water.

Cobalt chloride. A very small amount need be purchased, say about 5 grams. Make up into a one per cent solution. Into this fluid ordinary thin, preferably filter paper or tough tissue paper may be dipped and dried. When thoroughly dry the color is bright blue. If a small fragment of the paper is land on the palm of the hand it will lose the blue color as a result of the action of moisture upon the chemical. For this reason, very instructive experiments to show the loss of water

by the leaves of plants may be done by placing similar squares of the paper in contact with a leaf and protected from the atmosphere by small slips of glass.

Pyrogallic acid.

Diastase. (Taka.)

Thymol.

Caustic potash or common potash lye.

Alcohol (denatured will do).

Fehling's Solution. This can be made up as follows: Dissolve 35 grams of sulphate of copper, 173 grams of Rochelle salts, 120 grams caustic soda, each in one litre of water. For testing tissues and fluids for the presence of sugar take equal amounts of each solution with two similar volumes of water, unless you are testing a fluid. For the purpose of learning to apply this test, place a small piece of onion or beet in a test-tube with a small amount of Fehling's solution and boil over an alcohol lamp. You should get a red precipitate of a copper oxide, indicating the presence of grape sugar.

Glycerin.

Iodine. In a one per cent. solution of potassium iodide place enough iodine crystals so that when dissolved you will have a solution of rather dark sherry color. It takes a very small amount of iodine.

Red ink will serve for coloring water which may be used for tracing the path of the water through translucent stems and leaves. Also for staining, combined with or following Iodine.

Nitric Acid.

Hydrochloric Acid.

Sulphuric Acid.

Phloroglucine.

Gelatin.

Extract of Beef.

Mercuric chloride tablets for disinfection of hands.

Equipment.

It is quite important that, as quickly as possible, schools should provide space for a laboratory. The planning of a laboratory calls for special treatment in each case, according to the size and position of the room. Valuable hints may be obtained by consulting Ganong's Plant Physiology and Lloyd and Bigelow's Teaching of Biology. It would be wise to enter into correspondence with the Professors of Zoology and Botany in the State institutions of learning, or with the State Superintendents, who will refer you to proper sources of advice.

The equipment, aside from tables, and other furniture will consist of the following articles, which are purchasable in sufficient quantities for 15 to twenty pupils for about \$75.00 to \$100.00 aside from a compound microscope, which will cost about \$30.00.

For each pupil, not necessarily used exclusively by one alone, the following articles are generally required:

One pair small scissors.

One pair medium sized forceps.

One scalpel (or pocket knife).

Two dissecting needles.

One hand lens (a Coddington, costing about \$1.00).

Two watch glasses (white butter dishes will answer).

One pipette (medicine dropper).

Note book with blank paper. There are several prepared note-books, with blank forms or guides to study, on the market, some of them good. These may prove of use.

The instructor will need:

1 Compound microscope, for study and for demonstrating special matters to the pupils, who will not have time enough for independent microscopic work, at least at present.

I Sectioning knife.

A supply of glass slips and cover glasses.

General laboratory equipment in addition may be made up approximately as follows:

Several retort stands.

Balances and weights (The torsion balance is cheap and very accurate).

Glass tubing of various sizes.

Filter paper.

Rubber tubing.

Sealing wax.

Copper wire; finer sizes.

Wire cutting pliers.

Flat-nosed pilers.

One glass cutter, of steel roller type.

Other tools: hammer, saw, etc.

Glassware:

Stock reagent bottles, 500-1000 cc., capacity.

Dropping bottles, for reagents in use.

Glass jars (mason jars will prove frequently useful).

Saucers.

Apparatus.

Aquaria. Glass aquaria should be had for watching the growth in water of plants and small animals. Ordinary battery jars will serve the purpose very well. They should be kept covered with a piece of glass, cut to a suitable size.

Alcohol lamps may be purchased for 20 to 60 cents apiece.

Cylindrical lamp chimneys, will be found useful for a number of purposes.

Finger-bowls of clear glass.

One dozen 3 or 4 inch Petre dishes.

Plant Materials.

Plants mentioned in the outline may be purchased from any one of several supply houses. However, a little self-education, coupled with a little energy in hunting, will discover a lot of useful material. Many of the aquatic plants may be kept growing in aquaria.

Dealers in Laboratory Supplies.

Bausch and Lomb Optical Company, Rochester, N. Y.

Spencer Lens Company, Buffalo, N. Y.

Arthur H. Thomas Company, 12 and Walnut Streets, Philadelphia, Pa.

The Kny-Scheerer Company, 404-410 W. 27 th. St., New York N. Y. (This company has for sale botanical and zoological materials fresh or preserved; also microscopic slides, in additions to the usual supplies.)

H. H. Powers, Station A., Lincoln, Neb. (High grade microscopic slides for zoology.)

The Scientific Shop, 170 South Clinton St., Chicago, Ill. (Microscopes and especially microscopic mounts.)

The Cambridge Botanical Supply Company, Cambridge, Mass.

Supply Department, Marine Biological Laboratory, Woods Hall, Mass.

On request, any of the above firms will gladly send a complete set of catalogues, which will enable you to select intelligently all that will be required.




ZOOLOGY.

By DR. JOHN Y. GRAHAM.

It is the purpose of this syllabus to furnish the teachers of Zoology in the newly organized high schools with a number of suggestions as to the conduct of their work in this subject. Although details have been given (especially in outlining the first exercises) there has been no desire nor intention on the part of the writer to prescribe a set of inflexible directions which the teacher should feel bound to follow under all circumstances. Only when a considerable degree of initiative is left to the teacher can the best results be secured. I willingly admit therefore, that there may be conditions under which the best results can be obtained by a departure from the mode of treatment here suggested. Let me ask, however, that the plan outlined be given a fair trial and then let each teacher send to the writer any suggestions he may have to offer that in his opinion would lead to a better method of treatment. By that sort of co-operation we may in the course of time approximate more and more closely a "best" plan.

The course of study adopted by this state for the county high schools provides for Biology in the second year. The time allotted is three exercises each week for the entire year. For the present it seems best to divide this time equally between the two great sub-divisions of Biology, Zoology and Botany. For seasonal and for pedagogical reasons it is suggested that the first half year be devoted to Zoology. It is assumed that the prevailing custom relating to laboratory subjects will be followed and two of the three weekly periods for Zoology will be double periods, that is, one and one-half or two hours in length.

There are certain phases of biological study for which a compound microscope is absolutely necessary, but beginners can do a great deal of very excellent work with no other means of magnification than a simple and inexpensive lens. There should be, however, at least one good compound microscope



in every school. With such an instrument as the Bausch and Lomb BH a teacher can demonstrate structures too small to be seen with the unaided eye. Not only will such demonstrations keep up the interest of the students, but it will open to them in some measure the wonders of a world unknown to them before. The exercises planned in this outline are made on the assumption that the school is provided with one compound microscope only.

The adopted book for this course is Bailey and Coleman's "First Course in Biology." The page numbers in the following, unless otherwise stated, refer to the pages of Part II, "Animal Biology."

With these as the given factors I have endeavored to construct this outline.

It is not necessary here to enter upon details of laboratory plans. Suffice it to say that the work cannot be carried on in the ordinary school room with the usual type of desk. A well lighted room is necessary, but direct sunlight is to be avoided. A room 18x32 with the long side north and with three windows five feet wide on the north side will give space enough for one V shaped table at each of the north windows. Each of these tables would seat seven pupils. Such a room would provide space for as large a number as one instructor can handle. For details as to the arrangement of sinks, gas table, wall cases, lockers for students' outfits, blackboard, service tables, see Lloyd and Bigelow's "The Teaching of Biology" and Ganong's "The Teaching Botanist." Both of these books are indispensable to the teacher.

The laboratory should be equipped with at least the following apparatus:

One Compound Microscope, as good as Bausch and Lomb's BH with one eyepiece, a 2-3, and a 1-6 objective, a revolving nose piece.

Six dozen non-corrosive glass slides.

One-half dozen number 2 cover glasses 18 mm circles.

If the teacher has had training in the making of permanent mounts of microscopic objects, he will know what reagents

to order for this purpose. It is impossible in the space at my disposal to go into the subject fully enough to meet the needs of one who has had no training in this direction. At any rate temporary mounts in water will be sufficient for the purposes of this elementary course.

Two dozen battery jars 6x8 inches for aquaria.

Five dozen "Hazel" jars of one and one-half liter capacity.

One dozen crystalization dishes, or better, so called nappys, can be substituted from a local dealer.

Plain finger bowls, at about 30 cents a dozen. Tumblers can be secured locally.

Mosquito netting, lantern globes, and oyster plates for insect breeding cages, See Duggar's Agriculture.

Dissecting pans, made in this way: Buy at the hardware store, round tin pans 8 1-2 inches in diameter and two inches deep, made of one piece of tin, that is without seams. Paint them inside and out. When they are dry, place in each of them a score or so of BB shot. Distribute the shot evenly around the edge. Then pour in enough melted paraffine mixed with lamp black to cover the shot. Keep the pan level until cool and cool it as quickly as possible.

One dissecting microscope of the Barnes type for each student 50 Watch glasses.

One package of filter paper in sheets.

Insect nets, one "Plaukton" net.

Paraffine, lamp black, and shot for pans.

Towels.

Section razors.

Each student should be required to supply himself with the text-book.

A loose leaf note-book of the "Atlas Science Tablet" sort made up of covers, drawing papers, note paper.

A 4th drawing pencil, eraser, and one softer pencil.

A set of dissecting instruments consisting of at least: One pair of needles, one pair of scissors, one pair of forceps, one scalpel.

CHEMICALS.

Five gallons of denatured alcohol.

Five pounds of Formaldehyde.

One pound of Chloroform.

Glacial Acetic acid and Potassium Bichromate may be secured from the chemical department of the school or the local druggist.

One graduated cylinder 10 cc capacity

“ “ “ 100 cc

“ “ “ 1500 cc

MATERIAL.

I am not going to advocate “pickeled” biology. It is important for us to study living animals and to learn to think of them as acted upon by the world about them and as reacting upon that world. The questions put before the student therefore, are not only those concerning the structure of the dead animal but also those concerning the actions of the living one and more especially its relation to human interests. However, I think it advisable for every teacher of zoology to collect and preserve a certain amount of material before the beginning of the school year, to be used only when living material cannot be secured at the time required.

Grasshoppers: These can always be caught in large numbers in late summer. Follow the suggestions in the text as to methods of capture. Kill them with chloroform and preserve them in 70 per cent alcohol. Do not put too many in one jar. After one day pour off the alcohol and replace it with fresh spirit of the same strength. Preserve some of them in 3 per cent formaline.

Wasps. *Polistes* are not hard to get. These are the social wasps that build flat cake shaped nests suspended by a slender stem on the under side of leaves and in similar situations. If you can find a nest attached to a fairly smooth surface, proceed, in this way. Get a battery jar large enough to cover the nest and a piece of tin large enough to serve as a cover

of the jar. Put the jar over the nest and then quickly push the tin across the top of the jar between it and the support on which the nest is in such a way as to detach the nest. It then falls into the jar. Of course you will keep the jar carefully covered and after withdrawing to safe distance slip into it a piece of cotton wet with chloroform. In this way you can get not only the nest and a large number of adult wasps but also many eggs and a number of larvae and pupae.

"Yellow-jackets"—the kind that live in holes in the ground can be secured in large numbers by removing the base from a fly trap and placing the two upper parts over the entrance to the nest. The trap I refer to is the kind consisting of an inner cone of wire gauze with a hole at the apex (it will be necessary to make this hole a little larger by forcing a lead pencil through it), and an outer truncated cone of the same material.

Beetles are not hard to get in various situations but it is a good plan to capture a large number of "June bugs" (the fig-eater, *Allorhina nitida*) at the time they are swarming.

Earthworms. These may be kept alive in the laboratory for a long time by following the suggestions of the text-book, page 42. Some of them should be killed and preserved in the following manner. First it is necessary to clear the intestine of the worm of sand so that the hand sections called for in exercise 21 can be made without injury to the razor. To this end make a pulp of filter paper by tearing it into fine shreds and then shaking it with water. Put the pulpy mass into a tall wide-mouthed bottle, drain off most of the water, and then put into it several worms that have been cleaned off all adhering earthy particles. The next day take the worms out of this mass of pulp and place them in a new mass prepared in the same way. After another day the worms will have voided all the sand and filled the alimentary canal with filter paper instead, and they are then ready for the next step. Kill them in this way: Put the worms in a low glass dish such as a crystallization dish or a "nappy," pour on enough water to cover them, put in the center of the dish something to support a

watch glass just above the level of the water. Wet a piece of cotton with chloroform, put it in the watch-glass and put the watch-glass on the support in the center of the dish. Cover the dish with a sheet of glass or some other practically airtight covering. The water will gradually absorb the chloroform vapor and after about six hours the worms will be motionless. Great care must be taken that none of the chloroform is dropped directly into the water. If this should happen the worms will squirm about, excrete quantities of slime, and thus become almost useless for our purposes. As soon as the worms are so thoroughly under the influence of the chloroform that they do not move when touched, they should be picked up one by one, stretched out straight, and held for a moment under the hardening fluid made as follows:

| | |
|----------------------|-----------|
| Potassium bichromate | 15 grams |
| Water | 500 c. c. |
| Glacial Acetic Acid | 30 c. c. |

The worms should be left in this fluid for 24 or 36 hours. Then pour it off and wash the worms in running water for one day. After that place them in four per cent. formaline, keeping them as straight as possible, put the jar into dark closet. A few hours before this material is needed for class use wash off the formaline in water or 70 per cent. alcohol. In material prepared in this way the various structures can be seen in the hand made sections with great distinctness. The blood vessels are dark in color, almost black, the nerve cord white, the parts of the body wall and intestine are somewhat differentiated from one another so that their study under the lens is greatly facilitated.

Mussels can be preserved in 3 or 4 per cent. formaline. It is possible by the use of chloral hydrate to kill them with the foot extended, but the method is somewhat uncertain and the advantage slight. A wooden wedge may be used to force open the shell then the animal may be placed directly in formaline leaving the wedge in place.

The study of the vertebrates should be made following the suggestions of the text on living or freshly killed specimens. It is not possible to secure frogs eggs at all times of the year and therefore it is advisable to preserve a series in formaline when they can be collected in February or March.

I have tried to point out in the following the order of treatment and some of the details of the first laboratory exercises. The three exercises each week should be used thus, two double laboratory periods and one recitation. Every laboratory exercise must result in some sort of record in the student's note-book. Both written descriptions and drawings should be required. These notes should be examined and graded after each exercise. This is easy to say but I will admit that it is hard to do, for it is the least interesting part of the teachers work. But it is very important, and if the natural sciences are to gain the place in the high school program those of us interested in them know they deserve, we will have to insist that the students not only observe the facts and reason correctly about them, but also express themselves orally and in writing in an acceptable manner. Moreover, if a student wishes to secure college entrance credit in zoology he must submit to the examiner's a certified note-book.

FIRST EXERCISE.

Subject: I. Nature of organisms. II. Oxidation. III Cell and Protoplasm.

I. Place on the laboratory tables as many of the substances named on page 1 of Coleman's *Animal Biology* as can be conveniently obtained. Write on the blackboard the names of other substances. Require each student to rule a page in his note-book in such a way as to make four columns and write at the head of the columns, organic, inorganic, used for food, not used for food. Let the student write the names of each substance in its proper column and writes the answers to the questions in the text.

II. Let each student carry out the simple experiments suggested on pages 4 and 5 and record in his note book what he did and exactly what happened.

III. The teacher should show under the compound microscope, (1) some of the hairs scrapped from a tomato vine or a water melon vine. This will show circulating protoplasm. (Of course Amoeba is excellent for this purpose if available.) (2) One of the ovarioles of a grasshopper will show egg cells—large ones loaded with yolk at the attached end and smaller ones at the free thread like end. These preparations should be mounted in water and covered with a cover glass. Require a record of these demonstrations.

Suggest that each student bring one or more living grasshoppers to the next exercise.

SECOND EXERCISE.

Subject: The Behavior of the Grasshopper and its Structure.

I. Let each student record in his note book, where and when he found the grasshopper, the weather conditions, how far it could fly, how far it could jump, does it show any resemblance to its haunt, etc. Each student should then be furnished with a grasshopper that has been kept in the laboratory several days without feeding. The most convenient way to give out this material is in low glass dishes covered with mosquito netting. First, watch the breathing motions. Describe this action. Feed it with clover. Describe this. Dip a broomstraw into weak acid and bring it near the head of the insect. How does it behave?

II. Structure. For this part of the study it is well to have a dead specimen in addition to the living one. Let each student write in his note-book answers to all the questions on pages 63, 64, and 65 (except those implying a comparison with the crawfish, which should be omitted for the present), and make all the drawings called for. At the close of the period each student should be furnished with small glass jar containing 70 per cent alcohol, in which he should place material that may be of further use later. First, of course, kill any living grasshoppers with chloroform. Refer to bulletins of the department of Agriculture on locusts.

THIRD EXERCISE.

Recitation on the foregoing. Demonstrate with the compound microscope the objects suggested on page 69. Require a record of the demonstration.

FOURTH EXERCISE.

Subject: Structure of the grasshopper continued. Pages 65 and 68 inclusive. After studying the external features cut off the wings of a dead grasshopper and with the fine pointed scissors make a cut through the body wall a little to one side of the mid-dorsal line, pull the cut edges apart, and pin them fast to the wax bottom of the dissecting pan. Then gently pour water into the pan—enough to cover the dissection. Study the food tube, breathing organs, reproductive system. The heart is a very slender tube and remains attached to the body wall. Look for it on the larger of the two flaps. Study pages 76-78 inclusive. The nervous system will be seen after removal of the food tube. It is probable that its study will have to be deferred until the next time. Suggest that student bring to the next exercise as many of the “kindred of the grasshopper” as possible. See pages 70 and 71.

FIFTH EXERCISE.

I. Report on insects collected. Require notes on where found, behavior, food, and as to whether or not they are harmful or beneficial to human interests.

II. Repeat the dissection of the grasshopper (furnish an uninjured specimen). Review rapidly the points gone over before and then study the nervous system and sense organs. Pages 78 and 79.

SIXTH EXERCISE.

Quiz on the foregoing. Bring out the facts of development and economic significance. See bulletins and reference books.

SEVENTH EXERCISE.

Development of the mosquito. 1 Egg raft of *Culex*, 2. Two or three stages of larvae. 5. Pupae. Students should draw each one of these stages, study their movements and methods of feeding. One battery jar aquarium for each group of four to six students will probably show a sufficient number of stages. Each jar should be covered with a piece of cheese cloth. A very efficient means of killing the mosquitoes is this: wet a small piece of cotton with chloroform and place it on top of the cheese cloth and cover the whole jar with a sheet of glass. Require reports to be given at the next exercise on the number of places in which mosquitoes may be found breeding. Direct attention to sagging eave-troughs and down-spouts stopped with leaves.

EIGHTH EXERCISE.

Reports on mosquitoes. Of course, stress should be laid on the relation on these insects to malaria and yellow fever. See bulletins and Howard's book on the Mosquito. Let the students arrange breeding cages of the type shown in Duggar's Agriculture, Fig. 166. Place in them cocoons, potato-beetles, caterpillars "spittle-bugs," etc.

NINTH EXERCISE.

Recitation on the foregoing and conference on note books.

TENTH EXERCISE.

Follow out the "illustrative studies" pages 87 et seq., substituting in every case possible insects brought in by the students for the pictures. Note suggestions on collecting, page 72.

ELEVENTH EXERCISE.

Continue the illustrative studies.

TWELFTH EXERCISE.

Review of insects. Require reports next time on spiders. Where found, action of spider when alarmed, when insect is caught in web.

THIRTEENTH EXERCISE.

Report on spiders. If a mangy cat or dog can be found, demonstrate to the class with the compound microscope the mange mite. Refer to Duggar's Agriculture and bulletins on cattle tick.

Exercises 14 to 18 inclusive should be devoted to the study of the crawfish. Require notes and drawings according to the suggestions of the book, pages 51-61 inclusive.

NINETEENTH EXERCISE.

Have on hand as large a collection of Arthropods as possible for example, a crawfish, a crab, a shrimp, a myriapod, a spider, a pill bug, various insects. By questions develop the meaning of bi-lateral symmetry, body segment, segmented limbs, which have no antennae, which one pair, which two pair, which are gill breathing, which air breathing. Further reports on breeding cages.

Exercises 20, 21, and 22 should be devoted to a study of the earthworm. Both living and preserved material should be issued. In addition to the usual dissection indicated in the text, the following very instructive supplementary exercises should be carried out. Take one of the hardened worms, cut off the anterior end, say the first 18 segments, hold it between the thumb and index finger of the left hand and then cut it with a short razor into its right and left halves. Place the pieces in a watch glass in water and study the cut surface with a lens. Compare this with a dissection made from above and with figure 72. Great care should be exercised in making the cut. It is important that the razor pass exactly from the mid-dorsal to the mid-ventral line and that the cut be made at one stroke. 2. Take another piece about an inch long and divide

it by a horizontal cut into a dorsal and ventral half. 3. Cut a few transverse sections from the remaining part of the worm. Require a record in the form of carefully made drawings and notes. Be sure that the student correlates the sections and the first dissection.

TWENTY-THIRD EXERCISE.

By this time the aquarium will perhaps yield specimens of small fresh water segmented worms belonging to the family naididae. Their method of a sexual reproduction should be noted.

Planarians can sometimes be obtained in this way: place pieces of fresh meat among the water plants of a slow running brook or at the margin of a pond. After about two hours scores (if you are lucky) of *Puanaria* will be found adhering to the under surface of the meat. The student should give attention to the behavior of the animal and its more general characteristics. Find the eyes, the mouth. Occasionally the pharynx will be protruded. Watch the animal feeding on the sides of the aquarium.

TWENTY-FOURTH EXERCISE.

Practical work on the parasitic worms must of necessity be limited in a course of this sort. It is possible but perhaps not advisable to get from the butcher a hog's liver containing what they call boils. This and muscles called "measly" are likely to contain the cysticercus stage of tape-worms. This may be omitted, but what I am to mention now should certainly be done: place in the hands of each student a copy of the circular entitled "Soil Pollution" issued by the Rockefeller Sanitary Commission. These may be obtained free of charge by writing to the above Commission, 811 Union Trust Building, Washington, D. C. The lessons in regard to sanitation, the importance of cleaning the back yard and keeping it clean, the importance of clean food, clean water, and clean air for for man and beast can not be too forcibly driven home. The co-operation of some local physician might be secured at this point.

TWENTY-SIXTH EXERCISE.

Hydra may sometimes be obtained by using a fine plankton net in quiet waters. This method is worth trying. I have had better success, however, by gathering submerged objects and carrying them in water into the laboratory and then distributing them in aquarium jars. A careful examination the next day may reveal hydras attached to the surface film or the sides of the glass or to the submerged objects. Use small aquarium jars. A reading glass is of great service in making the examination. A good study that can be carried out without a compound microscope is this: place the hydra in a watch glass with a small mosquito larva or a "water flea," (a *Baphnia* or *Cyclops*). To see the hydra paralyze and ingest its prey always excites interest.

It seems necessary on account of the limited time allotted to this subject and the technical difficulties involved to omit further studies of the Coelenterates as well as the Protozoa, Sponges and Echinoderms.

Exercises 26-29 inclusive, should be devoted to a study of the Mollusca. The best material for this work is found in the fresh-water mussel. If this is not to be found locally, it can be purchased at a small cost from dealers in laboratory materials. Slugs and pond snails can always be secured. The latter often lay eggs in the aquaria. Let the class keep several sets of them under observation for some time. Require of each student a record in his note book as to time necessary for development. Call for reports on the economic significance of the mollusks, e. g., Oyster fisheries, Dangers from Oysters "fattened" in Polluted Waters, Pearl-button Industry, Losses Caused by Ship-worms, etc. See encyclopedias, and bulletins

The rest of the course about 24 exercises should be devoted to a study of the Vertebrates. The material needed will be fishes (minnows or perch), frogs, lizards, birds (English Sparrows), mice or rats, but the course should not be limited to these animals, nor should it be a course in comparative anatomy. The suggestions in the text will probably be found sufficient in general. At every point emphasis should be laid

on the relation of the group under consideration to human interests. Here especially will Hodge's books be found helpful, *Nature Study and Life* and a new book soon to appear on applied biology. Without developing any sentimentality let the students gain a respect for, and a rational sympathy with life in all its forms. Attention should be called to the enormous losses due to rats and mice, to the danger to public health from rats as a carrier of the bubonic plague, of the probability that this will become a question of importance to this state in the near future when the Panama Canal is completed. If adequate reference books are at hand call for reports on such topics as these: *Food Value of Fishes*, *Fish in Relation to Aquatic Insects*, *The Usefulness of Toads*, *Lizards*, *Snakes*, and *Birds in holding Insect-pests in Check*. Why not *Domesticate more Animals*, *Mutual Aid among Animals* (see writings of Kropokin and Thompson and Geddes), *Behavior of Wild Animals*.

The teacher should have as many of the standard works on Zoology as can be secured. Some of the most necessary ones I have listed below.

Lloyd and Bigelow, *The Teaching of Biology in the Secondary School*, Longmans, Green, and Co., 91 and 93 Fifth Avenue, New York.

Osborn, *Economic Zoology*, The Macmillan Co., New York.

Linville and Kelly, *A Text-book in General Zoology*, Ginn and Company, Boston.

Jordan, Kellogg, and Heath, *Animals*, D. Appleton and Co., New York.

Parker and Haswell, *A Text-book of Zoology*, two volumes, The Macmillan Company, New York.

Galloway, *First Course in Zoology*, P. Blackiston's Son & Co. 1012 Walnut Street, Philadelphia.

Comstock, *A Manual of the Study of Insects*, Comstock Publishing Co., Ithaca, New York.

Davenport, *Introduction to Zoology*, The Macmillan Co., N. Y. Thompson, *Outlines of Zoology*.

Hodge, *Nature Study and Life*, Ginn and Company, Boston.

PHYSICS.

By PROFESSOR L. N. DUNCAN.

Physics should come in the third year of the high school course and should be given four recitation periods per week for the entire year for class room and laboratory work.

The course in high school physics should embrace:

(1)—A careful study of one of the best high school texts on physics.

(2)—As many experiments should be made as possible in connection with the class room work in order to illustrate the text.

(3)—Each pupil should be required to perform at least thirty-five experiments where laboratory equipment is available.

In the class room, high school physics should be taught largely from the standpoint of natural philosophy. The pupils should be made familiar with the fundamental physical laws of nature. The best results will be obtained if the observation and spirit of inquiry of the student is developed. This is best done by starting with some of the simple phenomena and showing the pupil by questions and explanations the reasons for the changes and the laws governing them. In the same manner the pupil should be led step by step into the larger and more difficult laws and problems of physics.

In connection with the lessons, it should always be the purpose of the teacher to have some simple experiments to aid the pupils to a clear understanding of the text. If the apparatus is not at hand and it is impossible to make the experiment in the class room, drawings on the blackboard are a great aid in helping the pupils to understand the explanations. It is a most excellent practice to have the pupils go to the board and make drawings to bring out and impress upon their minds the important facts of the lesson. Liberal use should be made of

these drawings in the class even if the experiments are conducted in the presence of the pupils. The careful drawings of the apparatus with which an experiment is made is an excellent practice for the class.

It should be the purpose of every high school to have as thoroughly equipped physical laboratory as possible and to require each student to perform at least thirty-five experiments in this laboratory independent of the work in the text. A carefully selected list of such experiments is given below. Of course this list may be varied to suit the teacher.

Each pupil should keep a special note-book for physics bearing a record of the work in physics and nothing else. In making a record of an experiment performed the following outline may be used:

Experiment No. _____ Date _____

Object of the Experiment.

Under this heading the main purposes of the experiment should be clearly and concisely stated.

Apparatus.

A short description of the equipment necessary in carrying on the experiment should be given. It is best to have a diagram or drawing showing the different parts of the apparatus. This drawing should be insisted upon when it is possible for the pupil to make it.

Observations.

Each step in proceeding with the work should be recorded here from the setting up of the apparatus until the work is concluded. A brief description of how each part of the work is done and how the results were obtained is a necessary part of the experiment if the pupil is to clearly understand the work and draw the proper conclusions. In all cases where there are a series of readings or in any case where there are a number of figures the results should be carefully tabulated.

Calculations.

After the experiment has been finished and the data recorded, all necessary calculations should be carefully made and the work checked to avoid any errors.

General Conclusions.

Each pupil should be required to write an account of the entire experiment, describing each step and drawing all conclusions. It is very important that the pupils write down what they learned from the experiment and if it is what was expected or not. The reasons for success or failure should be given.

These note books should be an important part of the physics course. They should be carefully looked over by the teacher and all errors noted for the pupils.

Every effort possible should be made by the teacher to encourage the pupils towards original work. Frequently when the laboratory equipment is limited, pupils may be induced to devise some simple apparatus to be used to develop some very important principle. The simpler the apparatus and the more it can be devised by the pupils the more effective will be the teaching. The teacher should realize that there are a large number of experiments that can be made with the simple material at hand.

In all the work in physics the teacher should strive to develop clear and accurate thinking on the part of the pupils. If physics is taught in the high school mainly with a view to making the students familiar with the simple and fundamental physical laws of nature, with their application to every day affairs, it may be made one of the most valuable subjects of the course in developing observation, thought and a desire to know.

For information in regard to carrying out these experiments the teacher should consult one of the physical laboratory manuals.

Some Experiments.

1. Measure dimensions of a rectangular block.
2. Compare the metric and English units of length.
3. Find the volume of a small solid insoluble substance.
4. Find the density of marble.
5. The work necessary in drawing a mass up an inclined plane is equal to the work necessary to raise the same mass vertically to the same height.
6. Prove in the law of the lever that the power multiplied by the length of the power arm is equal to the weight multiplied by the weight arm. Work this for first, second and third class levers.
7. Find the advantage of the movable pulley.
8. Show how air may be compressed.
9. Show how water may be made to expand by heat.
10. Show the cohesion of water at its surface.
11. Show the tension of a soap solution.
12. Illustrate the action of two simultaneous forces acting upon a movable body at an angle of 45 degrees.
13. Find the centre of gravity of a body.
14. Prove the laws of the pendulum.
15. Show the relation between depth and the pressure in a given area of fluid.
16. Find the relation between weight of a solid and the weight of the displaced water.
17. Show the relation between the weights of equal volumes of wood and iron.
18. Find the specific gravity of wood, iron and glass.
19. Find the specific gravity of salt and sugar.
20. Bring two liquids of different specific gravities together with a siphon without mixing the liquids.
21. Test the boiling and freezing points of the thermometer.
22. Test the effect of pressure on boiling point of water.
23. Test the effect of melting and freezing substances.
24. Find the melting point of a substance; the freezing point.
25. Study wave motion by means of water.
26. Test sound wave lengths by use of tuning fork and open tubes.

27. Study the distribution of light.
28. Test the power of different sources of light.
29. Study images in mirrors.
30. Effect of a prism on a ray of light.
31. Study refraction and reflection in water.
32. Study static electricity by use of pith balls.
33. Find the field of a magnet.
34. Determine the effect of induction and conduction in electricity.
35. Prepare and study the simple electrical cell.

Physical Apparatus for a Class of Ten,

| | Approximate Cost. |
|--|----------------------|
| 1 micrometer caliper ----- | \$ 4 00 |
| 1 doz. reagent bottles, glass-stoppered, 4 oz. ----- | 1 85 |
| 5 Florence flasks, 250 cc ----- | 40 |
| 10 student lamp chimneys ----- | 50 |
| $\frac{1}{2}$ lb. German silver wire, No. 28 ----- | 30 |
| 2 lbs. of brass wire, Nos. 22 and 28 ----- | 1 00 |
| 3 lbs. of cotton insulated copper wire, Nos. 18 and 24 ----- | 2 50 |
| 2 lbs. of iron wire, Nos. 28 and 32 ----- | 1 50 |
| 1 lb. of copper wire, No. 24 ----- | 90 |
| 1 iron, soldering, and 1 lb. solder ----- | 75 |
| 1 gross test tubes, 6 in. x $\frac{3}{4}$ in ----- | 2 88 |
| 5 National trip balances ----- | 27 00 |
| 10 battery jars, white glass, 4 in. x 5 in ----- | 2 50 |

Mechanics.

| | |
|--|------|
| 2 boards, composition of forces ----- | 4 00 |
| 6 balances, spring, 2 kg ----- | 2 40 |
| 10 balls, iron, 1 in. in diameter ----- | 80 |
| 10 balls, wood, 1 in. in diameter ----- | 1 00 |
| 5 wagons for inclined planes ----- | 5 00 |
| 12 glass marbles, $\frac{3}{4}$ in ----- | 12 |

Hydrodynamics and Pneumatics.

| | |
|--|-------|
| 2 apparatus, Boyle's law..... | 4 00 |
| 1 pump, air, exhaust and condense..... | 22 50 |
| 10 cans, overflow, nickel plated..... | 6 00 |
| 10 blocks, rectangular, 4 x 8 x 8cm., hard wood..... | 25 |
| 20 tubes, thistle, 12 in. long, 1-8 in. bore..... | 10 |
| 5 glass funnels, 3½ in..... | 14 |
| 1 doz. test tubes, 6 in. x ¾ in..... | 72 |
| 2 lbs. tubing, barometer, 11 mm. bore, heavy..... | 55 |
| 2 lbs. tubing, thermometer, 11 mm. bore, heavy..... | 1 00 |
| 5 lbs. tubing, soft glass, 3 mm. bore..... | 40 |
| 1 set equilibrium tubes | 85 |
| 1 glass model of lifting pump..... | 1 75 |
| 1 glass model of force pump..... | 2 00 |
| 1 U-shaped tube to show the principle of hydrostatic press -- | 25 |
| 1 glass model of hydraulic press..... | 2 00 |
| 1 set of Pascal's vases..... | 4 25 |
| 1 demonstration hydrometer | 20 |
| 1 glass hydrometer for both light and heavy liquids.. | 1 50 |
| 6 specific gravity bottles, 2 oz..... | 60 |
| 1 water hammer | 80 |
| 1 plain glass siphon | 25 |
| 1 glass tube with bulb to show expansive power of air | 15 |
| 1 thin rubber football..... | 1 00 |

Heat.

| | |
|--|-------|
| 1 model steam engine | 3 50 |
| 5 air thermometers | 1 25 |
| 5 apparatus "A," low form with screw top..... | 12 50 |
| 1 chemical thermometer, Centigrade..... | 1 60 |
| 1 condenser for distillation | 2 25 |
| 1 brass ring and ball to illustrate expansion..... | 1 25 |
| 1 compound bar for showing unequal dilation of dif- ferent metals | 1 25 |
| 1 palm glass | 50 |

Light.

| | |
|--|------|
| 5 plane mirrors, 6 in. x 2 in.----- | 75 |
| 5 cylindrical mirrors ----- | 2 50 |
| 10 lenses, double convex, 10 cm. focus----- | 1 00 |
| 1 specimen of Iceland spar----- | 50 |
| 10 prisms, glass, 3 in. x 1 in.----- | 4 00 |
| 1 Newton color disc and 5 other color discs----- | 1 00 |

Sound.

| | |
|--|------|
| 5 tuning forks, middle C----- | 75 |
| 1 diapason -- ----- | 3 50 |
| 1 sonometer -- ----- | 5 00 |
| 1 heavy bass bow ----- | 1 50 |
| 1 organ pipe with piston ----- | 4 25 |
| 1 siren disc and attachment----- | 4 00 |
| 5 tubes, resonance, 18 in. x 1½ in.----- | 2 25 |

Electricity.

| | |
|--|-------|
| 10 bar magnets, 6 in. long----- | 2 00 |
| 5 compasses, needle ½ in. long----- | 75 |
| 5 pith balls and rod of sealing wax----- | 30 |
| 1 glass friction rod ----- | 40 |
| 5 galvanometers -- ----- | 17 50 |
| 1 electro magnet, 4 in.----- | 1 20 |
| 1 motor, Porter No. 2----- | 7 50 |
| 5 electric bells ----- | 3 00 |
| 1 catskin -- ----- | 75 |
| 1 horseshoe magnet ----- | 1 00 |
| 1 Geissler tube, 6 in.----- | 75 |
| 1 model dynamo ----- | 4 00 |
| 1 sounder and key together on iron base----- | 3 25 |
| 1 yard of Japanese silk----- | 50 |
| 1 electrophorus -- ----- | 2 00 |
| 10 strips of copper, 1½ x 10 cm., wire attached----- | 4 00 |
| 20 strips of zinc ----- | 75 |

| | |
|--|-------|
| 5 cells, Daniell's complete ----- | 12 00 |
| 1 apparatus for decomposing water----- | 2 50 |
| 1 Toepler-Holtz machine, 12 x 14 plates----- | 26 00 |
| 1 lb. fine iron turnings ----- | 10 |

Miscellaneous.

| | |
|---|------|
| 1 set of 6 in. cork borers----- | 1 00 |
| 5 alcohol lamps ----- | 50 |
| 25 asbestos sheets ----- | 45 |
| 25 iron gauzes ----- | 65 |
| 1 tinner's shares, 12 in. ----- | 2 25 |
| 1 gross of corks, assorted sizes----- | 1 50 |
| 2 lbs. of rubber stoppers, 1 and 2 holes----- | 2 25 |
| 10 five-inch files, 5 round and 5 triangular----- | 45 |
| 10 Mohr's pinchcocks ----- | 10 |
| 10 screw pinchcocks ----- | 30 |
| 10 graduates, metric cylinder, 100 cc. to 1 cc----- | 50 |
| 1 hydrometer, specific gravity scale, 7 to 1.85----- | 1 40 |
| 5 sets weights, metric 500 g. to 1 g. in wooden block-- | 3 00 |



CHEMISTRY.

By PROFESSOR B. B. ROSS.

The course of study for County High Schools in this State provides that Chemistry may be taken in the fourth year of the course, five periods per week during the first half year and three hours per week during second half year. As two laboratory periods are usually rated as equivalent to one recitation period, it will be found advantageous to use three periods per week for lecture and recitation work, while for the remaining two periods, allowed by the course of study, two laboratory periods of double length can be substituted, if the necessary time is available.

A portion of the time of three periods allotted for lecture and recitation purposes should be employed by the instructor in demonstration work, as many experiments as practicable being performed before the class, while the teacher can also use the blackboard to good advantage in pointing out to the class, by means of appropriate equations, the chemical changes connected with the experiments that have been employed, for illustration purposes.

In the selection of experiments to be performed before the class, as well as for directions and suggestions as to carrying them out, the hand-book prepared by the authors of the adopted text-book will be found to be of material assistance to the teacher, and it is suggested that every instructor provide himself with one of these hand-books.

Laboratory work at the present time is rightly considered to be a practically indispensable adjunct to a properly conducted course in elementary general chemistry and it is highly desirable that at least a limited laboratory equipment be secured with as little delay as possible.

The Department of Mechanical Drawing of the Alabama Polytechnic Institute has prepared designs and cuts of single laboratory desks, which will accommodate two students each, and also of double desks capable of accommodating four stu-

dents each. These desks can be purchased or constructed at quite moderate prices and will be found to answer quite well for use in the laboratories of secondary schools. Plans of these desks are appended herewith.

A number of the large apparatus and chemical supply houses of the country make a specialty of supplying small selected sets of apparatus and chemicals with a view to meeting the requirements both of chemical lecture rooms, and laboratories of high schools and an equipment adequate for the needs of an elementary course can be secured for a very moderate sum.

Several lists of apparatus and chemicals, with prices of same, are appended herewith, and the names and addresses of a number of apparatus supply houses are also given.

By improvising it is even possible to dispense with some of the items on these apparatus lists and it is surprising what a large number of striking and instructive experiments may be performed upon the lecture desk by the use of a very limited outfit.

Such simple pieces of apparatus as filter stands, test-tube racks, test-tube holders, etc., may be constructed by the students themselves, under the direction of the instructor, and the expense of the equipment can thus be somewhat decreased, while at the same time, the student is directing some of his energies along useful, practical lines.

While the purpose of a course in chemistry in a high school is to some extent disciplinary, the instructor should endeavor to inculcate in the pupil a due appreciation of the importance of the science in its relation to the processes of nature, to every day life and to the agricultural and industrial development of the country.

If the subject is properly presented to the pupil, its study should prove a most important agency in enabling him to observe accurately, to report clearly the results of his observations and to draw correct conclusions therefrom.

It is important that the student should make use of the notebook both in the lecture room and in the laboratory, and the instructor should examine note-books at regular intervals in

order to ascertain whether or not the notes are properly entered, while at the same time the teacher can form a good idea as to whether the pupil has a proper grasp of the subject or is drawing intelligent conclusions from the results of his observations.

Above all, it is most essential that the teacher take care that the work does not become mechanical, but on the contrary, he must see to it that the student thinks in carrying out the laboratory experiments assigned him. Each experiment should have a definite object or purpose and should be performed by the student with this object or purpose in view.

It will hardly be practicable to give the student any experiments except those of a qualitative character, although after the course has become well established, it may not be amiss to permit some of the more proficient students to undertake a few of the simple quantitative experiments given in the text. At least forty experiments or exercises should be undertaken during the course of the session and it is possible that even a larger number may be satisfactorily carried out. It is to be noted, however, that a number of different operations or sub-experiments are, in many cases, included under the head of a single experiment in the text-book, so that a single exercise may require a considerable amount of mental application as well as of laboratory manipulation, affording, in a single laboratory period, much useful practical and mental training to the student.

The following list of apparatus for a class of five in laboratory work in chemistry is reproduced from Hand-book No. 22, of the New York Educational Department. The prices of much of the glass ware are evidently based on duty free quotations, of which educational institutions can avail themselves. In fact, quite a considerable saving can be effected by importing laboratory apparatus duty free, though the order in such cases should be placed several months in advance of the opening of the school year.

A list of chemicals given in the same publication is also given below, though from this list are excluded such chemicals as are not needed in the experiments given in the adopted text-book,

while a supplementary list giving such additional chemicals as are used in the experiments referred to is also presented herewith.

Still another list, designated as "Chemical Set No. 2" is particularly designed for use for lecture room purposes and one of the large apparatus and supply houses proposes to furnish this set of apparatus for \$25.00, F. O. B., at point of shipment.

The following is a list of some of the principal apparatus and chemical supply houses:

Eimer and Amend, New York, Arthur H. Thomas Company, Philadelphia, Bausch and Lomb Company, Rochester, N. Y., Central Scientific Company, Chicago, Ill., Henry Heil Chemical Co., St. Louis, Mo.

Apparatus for a Class of Five in Chemistry,

| | Approximate Cost. |
|---|----------------------|
| 5 shallow agate pans, 1 qt.----- | \$ 0 75 |
| 1 balance, horn pan 8 in. beam ----- | 1 50 |
| 5 blow pipes, 8 in.----- | 30 |
| 5 Bunsen burners or alcohol lamps----- | 95 |
| 5 Burette clamps ----- | 1 70 |
| 5 clamps for test tubes----- | 40 |
| 1 set of cork borers, 1-6----- | 75 |
| 2 round files ----- | 15 |
| 2 triangular files ----- | 19 |
| 1 glass cutter ----- | 11 |
| 5 iron gauze, asbestos center, 5 in. x 5 in.----- | 55 |
| 5 cylinder graduates, 100 cc----- | 1 90 |
| 1 cylinder graduate, 500 cc----- | 75 |
| 5 filter paper boxes, 4 in. in diameter----- | 45 |
| 5 Mohr's pinchcocks, medium ----- | 45 |
| 6 porcelain crucibles with cover No. 00----- | 54 |
| 12 porcelain evaporating dishes, No. 00----- | 1 08 |
| 5 mortars, 3½, with pestle----- | 95 |

| | |
|---|------|
| 1 lb. 2 hole rubber stoppers No. 7----- | 1 69 |
| 1 lb. 1 hole rubber stoppers, to fit 4 in. U tube----- | 1 69 |
| 1 lb. 1 hole rubber stoppers, to fit 6 in. U tube----- | 1 69 |
| 10 ft. rubber tubing, 3-16 in., antimony----- | 52 |
| 15 ft. rubber tubing, $\frac{1}{4}$ ----- | 1 35 |
| 5 deflagrating spoons, $\frac{1}{2}$ -in. bowl----- | 38 |
| 5 iron stands, 3 rings----- | 2 45 |
| 10 test tube brushes ----- | 49 |
| 5 test tube racks ----- | 27 |
| 6 triangles, pipe stem, small (to fit No. 00 crucible)--- | 30 |
| 2 thermometers, chemical, 0-250 degrees C----- | 2 40 |
| 1 set of weights, 100 g. down to 1 mg----- | 3 40 |
| 1 $\frac{1}{4}$ lb. spool copper wire, No. 30----- | 21 |
| 1 Coddington lens ----- | 1 35 |
| 10 beakers, 200 cc----- | 1 00 |
| 3 sets of reagent bottles, 125 cc., 4 oz., NH_4OH , HCL , H_2SO_4 , HNO_3 , KOH , NaOH ----- | 3 57 |
| 2 bottles, N. M., $\frac{1}{2}$ gal.----- | 70 |
| 12 bottles, W. M., 6 oz.----- | 74 |
| 12 bottles, W. M., 8 oz----- | 87 |
| 2 burettes, 50 cc. grad. to 1-10 cc.----- | 2 62 |
| 5 Colbalt plates, 2 in. square----- | 15 |
| 5 cylinders, 2 in. x 12 in----- | 1 70 |
| 15 Florence flasks, 250 cc.----- | 1 20 |
| 15 Erlenmeyer flasks, 4 oz----- | 90 |
| 6 funnels, 60 degrees, $2\frac{1}{2}$ in.----- | 48 |
| 6 tubulated retorts, 150 cc.----- | 1 38 |
| 500 gm. glass rods, 3-16 in.----- | 30 |
| 200 test tubes, 6 in. x 5-8 in.----- | 2 56 |
| 10 test tubes, 6 in. x 5-8 in., hard glass----- | 1 20 |
| 5 U tubes, 4 in. arm----- | 55 |
| 5 U tubes, 6 in. arm----- | 60 |
| 500 gm. tubing, soft glass, 1-8 in. diam----- | 30 |
| 50 vials, with cork, height 80 mm., diam. 25 mm.----- | 1 13 |
| 10 watch glasses, 2 in. in diameter----- | 15 |
| 500 glass beads ----- | 75 |

Reagents.

| | |
|---|------|
| 1 lb. alum, potash, pure crystals | 23 |
| 1 oz. aluminum chloride, pure | 07 |
| 2 lbs. alcohol, 95% | 1 02 |
| 1 lb. ammonium carbonate C. P. | 35 |
| 1 lb. ammonium chloride C. P. | 32 |
| 4 lbs. ammonium hydrate | 70 |
| 1 oz. ammonium nitrate, pure cryst | 07 |
| 1 oz. ammonium sulphate, pure cryst | 05 |
| 2 lbs. barium chloride | 35 |
| 1 oz. barium nitrate C. P. | 23 |
| 1 oz. calcium chlorid, fused, white cakes | 07 |
| 1 oz. calcium nitrate C. P. | 07 |
| 1 lb. calcium oxid | 12 |
| 1 lb. carbon bisulphide, pure | 16 |
| 5 lbs. charcoal blocks | 20 |
| 1 lb. charcoal wood, powd | 08 |
| 1 oz. cobalt nitrate C. P. | 18 |
| 1 oz. copper sulphate C. P. | 09 |
| 1 lb. hydrogen peroxide C. P. | 50 |
| 1 lb. iron filing, clean, fine | 08 |
| 1 lb. iron sulphate (com'l) | 06 |
| 6 lbs. hydrochloric acid, C. P. Sp.Gr. 1.20 | 72 |
| 1 lb. lead, shot No. 10 | 14 |
| 1 lb. lead nitrate C. P. | 26 |
| 1/2 qr. litmus paper, red | 40 |
| 1/2 qr. litmus paper, blue | 40 |
| 1 lb. magnanese dioxide | 08 |
| 8 ozs. mercury oxid, red | 68 |
| 1 oz. nickel nitrate C. P. | 11 |
| 7 lbs. nitric acid, C. P. Sp. Gr. 1.42 | 1 00 |
| 2 ozs. phosphorous red | 15 |
| 2 oz. Phosphorous, yellow | 15 |
| 1 oz. potassium bromid C. P. | 07 |
| 2 lbs. potassium chlorate cryst | 32 |
| 1 lb. potassium ferricyanid, com'l. | 63 |
| 1 oz. potassium ferro cyanid C. P. | 07 |

| | |
|--|----|
| 2 lbs. potassium hydroxid C. P.----- | 85 |
| 1 oz. potassium iodide, cryst.----- | 25 |
| 1 lb. potassium nitrate, cryst.----- | 12 |
| 1 oz. potassium permanganate C. P.----- | 07 |
| 1 oz. silver nitrate C. P. cryst.----- | 60 |
| 1 oz. sodium metal ----- | 15 |
| 1 lb. sodium bicarbonate ----- | 06 |
| 1 lb. sodium biborate, powd.----- | 15 |
| 1 lb. sodium carbonate, dry----- | 06 |
| 2 lbs. sodium hydroxid ----- | 82 |
| 2 lbs. sodium hyposulphite ----- | 13 |
| 1 lb. sodium nitrate cryst.----- | 08 |
| 1 oz. strontium nitrate C. P. ----- | 07 |
| 2 lbs. sulphur flowers ----- | 13 |
| 9 lbs. sulphuric acid, Sp. Gr. 1.84 C. P.----- | 95 |
| 2 lbs. zinc, mossy ----- | 30 |
| 1 lb. zinc sticks C. P.----- | 29 |

Supplementary list of chemicals (to be added to the preceding list in order to supply the chemicals needed in the laboratory experiments of the adopted text.)

| | |
|---|-------|
| Aluminum foil, 1 oz.----- | \$ 20 |
| Aluminum Sulphate, C. P. 1 oz.----- | 10 |
| Antimony, 1 oz., C. P.----- | 15 |
| Antimony, tri-oxide, C. P., 1 oz.----- | 10 |
| Antimony, tri-chloride, pure cryst., 1 oz.----- | 20 |
| Barium, per-oxide, C. P., 2 oz.----- | 10 |
| Bismuth, C. P., 1 oz.----- | 40 |
| Bismuth, Nitrate, C. P., 1 oz.----- | 20 |
| Charcoal, Animal, powd., 1 lb.----- | 10 |
| Cadmium Sulphate, 1 oz., C. P.----- | 20 |
| Calcium Sulphate (Plaster Paris), 1 lb.----- | 10 |
| Calcium Sulphate (Gypsum cryst.), 1 lb.----- | 10 |
| Copper turnings, 1-2 lb. ----- | 20 |
| Copper Nitrate, C. P., 2 oz.----- | 15 |
| Ferrous Sulphide, 2 lbs. ----- | 36 |
| Ferric chloride, cryst. pure, 1-4 lb.----- | 10 |

| | |
|---|------------------|
| Grape Sugar, 1 lb.----- | 10 |
| Lead oxide (litharge), 1 lb. ----- | 15 |
| Marble (lumps), 1 lb.----- | 05 |
| Magnesium ribbon, 1 oz. ----- | 45 |
| Magnesite, 1 lb. ----- | 10 |
| Magnesium, chloride, C. P., 2 oz.----- | 10 |
| Magnesium Sulphate, C. P., 1-4 lb.----- | 10 |
| Mercuric Chloride, C. P., 1 oz.----- | 15 |
| Phosphoric Acid (syrupy), 1-4 lb. ----- | 15 |
| Potassium Chromate, C. P., 2 oz. ----- | 10 |
| Potassium Chloride, C. P., 2 oz.----- | 05 |
| Potassium Sulphate, C. P., 2 oz.----- | 05 |
| Potassium Sulphocyanate, C. P., 1 oz.----- | 10 |
| Potassium Bitartrate, C. P., 2 oz.----- | 20 |
| Sodium Acetate, C. P., 2 oz.----- | 10 |
| Sodium Carbonate, C. P., cryst., 1-2 lb.----- | 10 |
| Sodium Nitrite, C. P., 2 oz.----- | 20 |
| Sodium Sulphate, cryst. C. P., 1-4 lb.----- | 10 |
| Sodium Phosphate, C. P., 2 oz.----- | 10 |
| Strontium chloride, C. P., 2 oz.----- | 10 |
| Tin- granulated, 1-4 lb. ----- | 20 |
| Tin, bi-chloride (stannic) cryst., 2 oz.----- | 10 |
| Zinc Sulphate, C. P. cryst., 2 oz.----- | 05 |
| Platinum wire, 2 grams, No. 29----- | prices variable. |

Chemical Set No. 2, Cost, \$25.00

- $\frac{1}{2}$ lb. Acetic Acid.
- 1 lb. Hydrochloric Acid.
- 1 lb. Nitric Acid.
- 1 oz. Oxalic Acid.
- 2 lbs. Sulphuric Acid.
- 1 oz. Tartaric Acid.
- 1 oz. Ammonium Carbonate.
- 2 oz. Ammonium Chloride.
- $\frac{1}{2}$ lb. Ammonium Hydrate.
- 1 oz. Ammonium Nitrate.
- 1 oz. Ammonium Sulphide.
- $\frac{1}{2}$ pt. Alcohol Methyl.
- 2 oz. Alum.
- 2 oz. Animal Charcoal.
- 1 oz. Antimony.
- 1 oz. Arsenic Trioxide.
- 1 oz. Barium Chloride.
- 1 oz. Barium Nitrate.
- 1 oz. Borax.
- $\frac{1}{4}$ lb. Calcium Carbonate (marble).
- 2 oz. Calcium Chloride.
- 2 oz. Calcium Fluoride.
- $\frac{1}{4}$ lb. Calcium Sulphate.
- 1 oz. Carbon Bisulphide.
- 1 oz. Cobalt Nitrate.
- 4 oz. Copper Sulphate.
- 2 oz. Ether.
- 2 oz. Ferrous Suphate.
- 8 oz. Ferrous Sulphide.
- $\frac{1}{2}$ oz. Gall Nuts (Powdered).
- 1-8 oz. Gun Cotton.
- $\frac{1}{4}$ oz. Iodine.
- 2 oz. Galena.
- 1 oz. Lead Acetate.
- 4 oz. Lead Oxide (red).
- 4 oz. Lead Monoxide.

- $\frac{1}{2}$ oz. Litmus (best cubes).
- 12 in. Magnesium Ribbon.
- 4 oz. Magnesium Sulphate.
- 1 lb. Manganese Dioxide (powdered).
- 4 oz. Mercury.
- $\frac{1}{2}$ oz. Mercuric Chloride.
- $\frac{1}{2}$ oz. Mercuric Oxide.
- 12 in. Platinum Wire.
- $\frac{1}{2}$ oz. Phosphorus.
- 1-8 oz. Potassium (metallic).
- $\frac{1}{2}$ lb. Potassium Bichromate.
- 1 oz. Potassium Bromide.
- 2 oz. Potassium Carbonate.
- $\frac{1}{2}$ lb. Potassium Chlorate.
- 1 oz. Potassium Chromate.
- $\frac{1}{2}$ oz. Potassium Cyanide.
- 2 oz. Potassium Ferricyanide.
- 2 oz. Potassium Ferrioxalate.
- Beakers, nest of 4 (3 to 12 oz.)
- Blow Pipe, plain, 8 inch.
- Bottles, W. M., two 8 oz.
- Bottles, N. M., two 8 oz.
- Corks, 1 dozen, assorted.
- Crucibles, Hessian, nest, large 5s.
- Deflagrating Spoon, iron, 1-2 inch.
- Dish, Evaporating, 3 1-2 oz.
- Dish, Lead, 3 inch.
- File, Triangular, 4 inch.
- Filter Paper, 1 pkg., 4 inch.
- Flask, F. B., 4 oz.
- Flask, F. B., 8 oz.
- Flask, F. B., 16 oz.
- Funnel, 2 1-2 inch.
- Funnel, 3 1-2 inch.
- Gas Bag with stopcock, 1 gallon.
- Gas Generating Flask, 1 pint.
- Glass Tubing, 1-2 lb., 3-16 to 1-4.

Graduate, conical, 60 c. c.
Hand Balance, 5 inch beam with weight, in case.
Jar, Specie, for deflagration, 1-2 gallon.
Lamp, Alcohol, 4 oz.
Mortar, Wedgwood, 3 inch.
Pipette, long bulb, large.
Pneumatic, Trough, Student's.
Retort, glass, plain, 4 oz.
Restort Stand, 3 ring.
Rubber Tubing, 6 feet, 3-16 inch.
Sand Bath, 4 inch.
Test Tubes, 1 dozen, 6 by 5-8.
Test Tube Brush, sponge end.
Test Tube Holder, wire.
Thistle Tube.
U Tube, 6 inch.
Watch Glass, 2 1-2 inch.
Wire Gauze, 4 by 4.



AGRICULTURE.

By PROFESSOR L. N. DUNCAN.

Reasons for Teaching Agriculture in the High Schools.

1. The movement to have agriculture taught in our high school course is one of the results of the general tendency of all education at present to be practical or industrial. For a long time we have had well-rounded courses in text books and laboratories looking to the preparation of men for teaching, medicine, law and the ministry. These courses were vocational in that they sought to prepare the student for the successful practice of his chosen profession. So in like manner we believe that a man who is thoroughly familiar with the underlying principles and sciences on which agriculture is based combined with the art of farming, will be a better farmer.

2. The 1900 Census Report shows that of the 20,685,427 acres of farm lands in Alabama only 8,654,991 acres are improved and under cultivation. However, on this 8,654,991 acres of improved land the farmers of Alabama are producing in live stock, vegetables and farm crops a total of \$109,429,543 annually. There are still 12,030, 436 acres of farm land unimproved. If these unimproved lands are developed so that they will produce farm values at the same rate as the improved land a total of \$150,380,450 will be added annually to the income of the farmers of Alabama. In developing these unimproved lands and getting the most out of what Nature has given us, it is important that we direct our educational efforts along those lines which will better enable the farmers to intelligently improve this great resource of our State. In bringing this large area to a higher state of civilization, timber will have to be removed, roads made, thousands of homes and outbuildings will have to be built and large problems of terracing and drainage will have to be dealt with.

It should be the purpose and business of our schools to give definite training along all of the above lines so that the

citizen of the country will be as intelligent and as skillful about his business, as comfortable and as little exposed to unsanitary conditions as the man of the city. This training should also be of such a nature as will enable the farmer to get as large a profit as possible from the energy expended.

3. Another question of grave moment in Alabama is to get the farmers to use better methods of farming on the lands under cultivation. All of the farmers need definite instruction in the fundamental principles of seed selection, soil and soil manipulation, fertilization and fertilizers, rotation of crops, live stock and the handling and marketing of farm products.

The present system of making cotton the main and in a majority of cases the only crop is causing the farmer to purchase his meats, corn, hay and other supplies which he might produce. With the methods used it is also leading to vast loss from soil depletion. As a result of this one crop system the average production of cotton in Alabama is 160 pounds of lint per acre and 13.5 bushels of corn per acre.

4. Another important reason why our schools should be directed so as to improve conditions in the country, is the fact that more than 88 persons of every 100 in Alabama live on the farm and that 67.6 per cent of the people engaged in gainful occupations are farming.

5. It is admitted by all that the present tendency of the young men to leave the farms for the town and cities and to seek other callings than farming for their professions, unbalances the proportion of rural and urban population and is dangerous to the welfare of the State. If agriculture is properly taught in our high school course so that the pupil will be familiar with the underlying principles of agriculture and so that farming may be looked upon as a dignified, profitable profession, it will largely help to overcome this movement of people from the country to the cities. At least two boys out of every five should remain on the farm to feed the other three who move to town.

Special Note to Teachers.

I am aware of the fact that a great many teachers hesitate to undertake to teach the subject of agriculture to a class of students some of whom at least come from the farm, fearing that the pupils may know more of some phases of the work than the instructor does and also fearing that the child's parents may criticise the teaching of a subject by one who has never practiced it. There was a time when the farmer looked upon all efforts at teaching agriculture in the schools as "book farming" and thought it was of no value. As a result, however, of the work of the various farmers' organizations, the farmers' institutes, the work of the United States Department of Agriculture, the State Department of Agriculture, the College of Agriculture and the other movements for better farming, the farmer is now more willing than ever before to have agriculture a part of the school course and it will not be long until this will be demanded on the part of the farmer.

The teacher should realize that there are certain fundamental principles of agriculture, as of all other subjects, which have been reduced to teachable form and which may be learned and taught by any teacher. As a matter of fact there are few teachers who are skilled in the practice of most of the subjects taught in the school course. I have heard teachers successfully and effectively teach the subject of physiology who had never dissected a human body or even seen one dissected.

What we really wish to accomplish in the high school course in agriculture is to make the pupils thoroughly familiar with the basic principles of the subject and then to extend these principles by making the best use possible of laboratory exercises and the experiences of the pupils who come to the class from the farms. If the teacher would enter upon this subject with a desire to learn and a spirit of investigation, confidence would be gained as progress is made and great results accomplished. Every effort should be made by the teacher to make liberal use of the illustrative material at hand and to draw out by questions and written essays the valuable

experiences of the boys and girls who come to the school from the farms in the community. The leading community interest should be the main subject for discussion in the school and the pupils should be encouraged to have garden plots at their homes where they may apply to every day practice the principles learned in the schools.

In all of this work, however, the important fact must not be overlooked that the main purpose of all of our schools is not merely to give facts but to train and discipline boys and girls so that when they become men and women they may be capable of meeting the responsibilities and duties of citizenship and of life. A careful study of and a close contact with the soil, the living plants and animals, the insects, the trees, the flowers and the large problems of farming should be a part of the fundamental training of all of our boys and girls regardless of their ultimate profession.

The agricultural course for the high school is planned to cover the following important branches of the work:

First Year. This is a general course in elementary agriculture covering all of the great phases of agricultural work. This should be very thoroughly and carefully done as it lays the foundation for future study along the various special lines in the higher grades.

Second Year. The work this year embraces a special study of farm crops or agronomy.

Third Year. The work for this year is to be divided between the two important branches, animal husbandry and horticulture.

Fourth Year. The work this year is to be a special study of soils and fertilizers.

It will be noticed that I have suggested school garden work in each grade. I mean simply that each of the high schools should maintain at all times of the year the very best school garden possible and this school garden should be the nucleus for practically all of the agricultural work where possible.

The Alabama Polytechnic Institute is now preparing a small leaflet on school garden work which will be ready for use for

the coming session. This pamphlet is especially adapted to the crops and conditions in Alabama.

The school garden work is not to be a class room subject but is to be the laboratory phase and in all cases it should be the endeavor of the teacher to have something in the school garden to illustrate the lesson in the text, and when this is the case the class should meet in the school garden if it is convenient and not in the school room.

First Year.

In this course it is contemplated that physical geography is to run from the beginning of the session, three hours per week, until the last of February. It is thought that this subject can be finished by this time.

Beginning March first, agriculture is to be taught three hours per week through the three spring months, March, April and May. The text book recommended for this course is *Agriculture for Southern Schools*, by Professor J. F. Duggar, published by the Macmillan Company. This is an elementary book which is also adopted for use in the common schools. Its use in the high school should be as a review course. The pupils should be made thoroughly familiar with the fundamental principles of the plant, the soil, the fertilizing materials, the farm crops, the flowers, the forest and fruit trees, the diseases of plants, the insects, the farm live stock, the feeding of live stock and dairying.

In the high school where the teacher has more time for the work, it will be possible to make greater use of the large number of experiments and practical exercises suggested with nearly every chapter of this book. The pupils should be encouraged and assisted in every way in carrying these out. Greater opportunity is also offered here than in the common schools, where time is more limited, for making collections of plants, flowers, seeds and for more extended out-door work with the plant and objects themselves.

In addition to this review course the following bulletins and pamphlets, suggested by Professor Duggar, should be used as collateral reading by the teachers:

Laboratory Exercises. Bulletin No. 186, office of Expt. Sta. Reprint No. 382, from Yearbook, U. S. D. A. (1905).

Germination and Propagation. Farmers' Bulletin Nos. 253 and 157.

Plant Breeding. Farmers' Bulletin No. 446.

Drainage. Farmers' Bulletin No. 187.

Fertilizers. Farmers' Bulletin No. 192.

Leguminous Plants. Farmers' Bulletin No. 278.

Corn. Farmers' Bulletin Nos. 81, 199.

Cotton. Farmers' Bulletin No. 217.

*Crimson Clover. Ala. Experiment Station Bulletin No. 147.

Forestry. Farmers' Bulletin Nos. 134, 173, 358.

Flowers. Farmers' Bulletin No. 195.

Fruits. Farmers' Bulletin No. 154.

Vegetables. Farmers' Bulletin No. 255.

Poultry. Farmers' Bulletin Nos. 51, 287.

Live Stock. Farmers' Bulletin No. 106.

Bees. Farmers' Bulletin No. 59.

All of these bulletins can be obtained free from the United States Department of Agriculture, Washington, D. C. except the one marked * (Crimson Clover) which can be had from the Experiment Station, Auburn, Alabama.

Second Year.

One hour per week during the entire year is to be given to the study of agriculture. The work this year should be a study of the leading farm and staple crops of Alabama. As a text for this work a book on Southern Field Crops, which is now being prepared by Professor Duggar, of Auburn, is suggested. This book will be published and ready for use in time for the opening of the session this coming fall. According to an account given me by Professor Duggar, this book embraces a careful and accurate study of the important Alabama crops, oats, wheat, rye, barley, corn, rice, cotton, sugar cane, tobacco, sweet potatoes, peanuts, cowpeas and broom corn. Two series of exercises are given with each crop, one

adapted to use for high school students and the other for college students.

Let me urge that the teacher make every use possible of the plants themselves in this work. Visit near-by fields of the crop which is being studied if possible and if this is impossible have the pupils to bring in specimen plants. Have a regular note book for each pupil in which are kept all notes and observations. Request the pupils to read the lesson over and discuss it with their parents. This will connect the work with the home life and will help to get the co-operation of the parents.

Third Year.

Two hours per week are to be devoted to agriculture for the entire year. This time is to be divided between the subjects of animal husbandry and horticulture, giving eighteen or more recitation periods for animal husbandry and the remainder of the time to horticulture.

For the first part of the year the work will be animal husbandry. This work is to be a series of short, concise lectures on the place of live stock on the Alabama farm, the leading breeds of horses, cattle, sheep and hogs. As a text for this work, Professor D. T. Gray, of the Department of Animal Husbandry in the Alabama Polytechnic Institute, is preparing a leaflet. This leaflet will endeavor to make the pupils familiar with the leading breeds of horses, giving a brief history of the breeds, type of the animal and what it is especially suited for. A similar series of lectures on cattle is given. A brief history of the leading breeds and the characteristic markings of each breed and the leading points of difference between the dairy and beef types is set forth.

In like manner the study of the leading breeds of sheep and swine is taken up. This leaflet will be well illustrated with photographs of typical animals of the various breeds. It will also have drawings showing the different parts of the animal body, the location and value of the cuts of beef, pork, etc.

Score cards are given of the beef and dairy types and of swine and sheep. After the animals have been carefully studied according to the lectures given, the pupils should be required to judge several animals according to these score cards.

In the work in animal husbandry, nearby farms may be visited where animals may be found to observe and judge. There is scarcely a community in the State where it is not possible to find typical horses, hogs, sheep and cows for the pupils to study. Excursions should be made frequently to such farms and the text work well illustrated and carefully explained with the animal before the pupils.

For the horticultural work during the latter part of the year, Goff's *Symposium of Horticulture* is recommended as a text. This is a beginner's book on horticulture and is a series of elementary lectures on the subject, delivered by Professor Goff to students in the lower horticulture classes in the University of Wisconsin. It covers the various phases of seed testing, grafting, budding, pruning, transplanting and re-potting of plants. It also touches on the simple principles of the cold frame, the hot bed and the green house.

With a few pieces of lumber and a little work on the part of the teacher and pupils a cold frame may be constructed. In this work the pupil not only learns how to construct a cold frame but numerous vegetables may be grown in it in the winter and early spring months. In this way the cold frame may be made most interesting and instructive to the class in horticulture. Last February I saw a cold frame in connection with a school and in it were growing onions, radishes, head lettuce, cabbage and strawberries. During cold nights and days a piece of ordinary sheeting was spread over the cold frame for protection.

Fourth Year

Two hours per week for the second half of this year should be devoted to the study of agricultural chemistry. The best text for this work is Snyder's *Chemistry of Soils and Fertilizers*. This book treats somewhat in detail but in simple lan-

guage of the formation and classification of soils, the chemical composition of soils, the physical properties of soils, the process of nitrification, the fixation of atmospheric nitrogen, the sources of the fertilizing elements and the process of compounding them into fertilizer mixtures, rotation of crops, soil conservation and the methods of handling the soils.

It is possible in connection with this work to make excursions to near-by fields and hill sides and to note, in the washes and places of erosion, the process of soil formation and transportation. With little or no cost, apparatus may be devised for carrying out a number of the exercises outlined in the back of the text. By adapting the apparatus in the physical and chemical laboratories these exercises may be much extended. Numerous problems may be solved in connection with fertilizers. The pupils should be requested to bring questions and problems about fertilizers from their homes. These should be solved and explained in the class. This will be another means of interesting the farmers and securing their co-operation.



LATIN

By DR. W. B. SAFFOLD.

In my opinion the Latin course in the high school should be so conducted as to produce the following results:

1. A working vocabulary of not less than 1,500 or 2,000 words.
2. A thorough knowledge of the regular inflections and such irregular inflections as are of frequent occurrence.
3. An accurate knowledge of the principal rules of syntax.
4. Some facility in turning English sentences into Latin.
5. The ability to pronounce Latin according to the Roman Method.
6. The ability to "scan" dactylic hexameter.
7. The ability to translate with the aid of the dictionary practically any passage in Nepos, Caesar, Cicero (orations and easier essays), Ovid (Metamorphoses, Fasti, and Tristia), and Vergil; and to translate at sight with a fair amount of accuracy easy passages in the same authors.

Vocabulary.—It is patent that the last qualifications includes all the others. To get the necessary results here more attention must be paid to the acquisition of a vocabulary and slight translation than has heretofore been the general practice. During the first year the pupil should be required to learn the words in each day lesson, and when he has completed the beginner's book he should know practically every word in it. Systematic efforts to increase the vocabulary should be made throughout the course, and at the end of the fourth year he should know the meanings of about 2,000 words. (If the school year has 160 periods this can be accomplished at a rate of only three words a day.)

It is the common practice of teachers to discontinue all special effort in this direction, as soon as the beginner's book has been completed, under the assumption that the pupil will without further direction gradually strengthen his vocabulary.

This is a fallacy. To prove that it is, allow your class to proceed a few days without direction and then examine them. The acquisition of a vocabulary is a drudgery for teacher and pupil, but it is drudgery that yields great returns. The boy who knows the words of the beginner's book will not find it necessary to look up practically every word when he comes to read Caesar, and the boy who is constantly adding to his vocabulary while he is rereading Caesar will be spared an enormous amount of thumbing the dictionary later on. It is my belief that the lack of a vocabulary does more to discourage and dishearten pupils than all other causes combined.

Sight translation. The great benefit to be derived from practice in translating at sight is that thereby pupils are compelled to use correct methods, since the work is done under the teacher's eye. Practice in this then should begin early in the first year, and should be continued throughout the course with such frequency and regularity as will influence the pupil's method of preparing his set lessons. A book that has been edited for sight translation is not necessary. The regular edition of the author in use at the time will do, if the teacher will take care to select easy narrative passages and give the meaning of the words that the pupil could not be expected to know. When suitable passages can be found in the lessons of the next day it is well to use them, since the interest of the class is thus won. Every examination paper, even those of the first year, should contain a passage to be translated at sight, the class being notified, of course, at the beginning of the term that this will be done. In this way the temptation to use a translation will be lessened, for pupils will not be slow to realize that a "crib" is a hindrance rather than a help in preparing for such a test. Success here depends almost entirely upon the teacher. No other part of the Latin course makes so great a demand on his skill and patience, and nowhere else do the unaided efforts of the pupil count for so little.

Lodge's Vocabulary of High School Latin (Teacher's College, Columbia University) will be helpful to teachers in their attempts to increase the pupil's vocabulary and power to translate at sight.

Forms. During the first year as much time should be given to a mastery of forms as to the acquisition of a vocabulary, and before the end of the second year the pupil should have a thorough knowledge of all regular inflections and all common irregular forms. The teacher who would have his class accomplish this must demand oral as well as written work and must exercise his ingenuity in devising different methods of attack. In addition to having the paradigms recited or written as a whole, let him give number, person, mood, tense, case, etc., and ask for the Latin equivalent. Then, reversing the process, let him give the Latin form and ask where it is found. Variety can also be secured by occasionally calling upon the class to recite the forms in concert, and by having them correct each other's black-board work.

It is inadvisable to attempt to teach beginners the inflections by having them build the various forms out of the stems, case-endings, etc., e. g. *caput* from *capit*, *servus* from *servo*, for to do this serves only to confuse them. It is much better to have them learn only those forms which they will actually meet in their lessons. Give short lessons at first and spend a few minutes each day in reviewing. Subordinate everything else to thoroughness, for it will save time in the end. I am well aware that memorizing forms is tedious. However, there is no escaping it, for nothing but hard work and constant repetition is of any real value. Nor can it be postponed, since the future success of most pupils depends upon the work of the first year.

Syntax. There has been in recent years a wholesome reaction against that exaltation of syntax which made the reading lesson little more than an exercise in parsing. Inasmuch as it is not ignorance of syntax but the lack of a vocabulary and ignorance of forms which delay the pupil's progress, only so much drill in constructions should be required as is absolutely necessary to intellect reading, the less common phenomena being reserved for the college years. And these fundamental principles should be taught in connection with their practical application to the reading lesson rather than as abstractions. There is no greater waste of the pupil's time and energy than the common practice of requiring him to mem-

orize the rules of the grammar before they have been illustrated by examples. I do not advocate lax methods of teaching syntax. Far from it. The constructions that are necessary should be thoroughly taught. I think that constant practice in turning English sentences into Latin offers the best means of doing this.

Teachers who wish to know what constructions should be learned during the various years of the high school course will receive real assistance from "The Syntax of High School Latin," edited by Lee Byrne and published by the University of Chicago Press. This book consists of statistics and selected examples arranged under grammatical headings and in order of occurrence by fifty collaborators.

Writing Latin. Drill in turning English sentences into Latin is an excellent means of teaching forms, word order and syntax, especially syntax, since pupils understand constructions most readily when they are seen from the English point of view. Consequently it should begin early in the first year and extend throughout the course. It should include also oral as well as written work, since the former makes it impossible for pupils to copy the needed forms from the grammar or from each other, which is frequently done when written work alone is relied on. Oral work has the added advantage that it effects a saving of time, since written work is of necessity a slower process. In the written as well as the oral exercises it is better to use short sentences. Furthermore, inasmuch as many Latin composition manuals are poorly made, especially those in which the exercises are based on the text of some Latin author, it is incumbent on the teacher to look through each lesson in advance in order that he may give needed assistance on points which his class cannot be expected to know.

Pronunciation. Nothing more should be attempted here than such proficiency as will enable teacher and pupil to understand each other. The sounds of the letters which should be learned from the teacher's lips, and the rules for syllabication and accent should be thoroughly mastered. The study of quantities, however, can be safely restricted to final syllables and vowels before a single consonant in penultimate syllables.

To require high school pupils to work *all* the quantities in the exercises is worse than useless. As for hidden quantities, these, like the minutiae of syntax, should be reserved for college years.

Prosody. The ability to 'scan' the dactylic hexameter is essential to the full appreciation of Vergil and Ovid. And by scanning I do not mean the mechanical division of words into feet with a monotonous fall of the voice at the end of each verse. Such reading is worse than none at all. If the teacher understands the art of metrical reading it will not be very difficult for his class to learn it from him. Teachers who desire a more detailed treatment of the dactylic hexameter than than contained in the school grammars will find it in Johnston's *Metrical Licenses of Vergil* (Scott Foresman & Co.) and Richardson's *Helps to the Reading of Classical Latin Poetry*, (Ginn & Co.)

General

It is imperative that from the very beginning good English be insisted upon in every sentence that is translated, since it is a matter of the greatest difficulty to correct careless and slovenly habits of translating when once they have been formed. Eternal vigilance on the part of the teacher, therefore, is necessary in order to check the tendency, displayed by most pupils, to use under all circumstances the meaning of the Latin word which they learned first, to translate by the English word which most nearly resembles the Latin, and to proceed generally in the line of least resistance. It is, of course, difficult to prevent this, since the pupil's alternative is given up almost entirely to getting the meaning of the passage. Nevertheless, neglect here subjects teachers of Latin to well deserved criticism.

Caesar is much too difficult to follow immediately after the beginner's book. If then, we are to prevent wholesale desertions from the Latin classes at the beginning of the second year, easier Latin than that of the Gallic Wars must be read during the first three or four months of this year. Such Latin

can be found in *Viri Romae*, *Gradatim*, *Eutropius*, simplified editions of *Caesar*, *Nepos*, etc. Of these *Viri Romae* is, all things considered, the best. The fact that the Latin is not classical is unimportant. If circumstances compel the teacher to put his class in *Cæsar* without giving them this preliminary work, he should for several weeks assign short lessons, give assistance on the lesson of the next day, omit the more difficult passages, and hold frequent reviews. However, the interest of the average class cannot be held if *Caesar* is read for an entire year. It is much better, therefore, to give at least three months to other reading, preferably to one of the books mentioned above. Time which appears to be lost when this is done will be regained before the end of the year.

It is equally difficult to keep pupils interested while six orations of *Cicero* and six books of *Vergil* are being read. It is, therefore, advisable that an equivalent amount of *Cicero's* Letters and *Ovid's* *Metamorphoses* be substituted for two orations of *Cicero* and two books of *Vergil* respectively. The six (or four) orations should be selected from the following; those against *Catiline*, for the *Manilian Law*, for *Archias*, and for *Marcellus*; while *Aeneid* III and IV should be omitted by classes that read only four books of *Vergil*.

It is strongly to be recommended that an interest be aroused on the part of the class in the personality of the author that is being read at the time. In the case of *Caesar* and *Cicero* especially there is much to tell that will interest even young pupils. A great deal can be done to relieve the traditional dullness of the ordinary Latin recitation if the teacher will in occasional and informal talks tell his pupils about such matters as the following: the geography of Gaul, the manners and customs of the Gauls, the army, weapons, etc., of the Romans, the fairness of *Cicero's* arguments, social and political conditions in Rome at the outbreak of *Catiline's* conspiracy, the Forum and the other public buildings at Rome, the decline of the Republic and its causes, *Vergil's* debt to *Homer*, *Vergil's* influence on later literatures, etc.

FRENCH AND GERMAN

By PROFESSOR J. J. DOSTER.

The value of modern language in secondary education is thus stated by the Committee of Twelve: "Aside from the general disciplinary value common to linguistic and literary studies, the study of French and German in the secondary schools is profitable in three ways: First, as an introduction to the life and literature of France and Germany; secondly, as a preparation for intellectual pursuits that require the ability to read French and German for information; thirdly, as the foundation of an accomplishment that may become useful in business and travel. * * *

What we have called the general disciplinary value of linguistic and literary study is well understood the world over, and has long been recognized in the educational arrangements of every civilized nation. The study of a language other than the other tongue requires the learner to compare and discriminate, thus training the analytic and reflection faculties. The effort to express himself in unfamiliar idiom, to translate from it into his own, makes him attentive to the meaning of words, gives a new insight into the possible resources of expression, and cultivates precision of thought and statement. Incidentally the memory is strengthened and the power of steady application developed. In time such study opens the gate to a new literature, thus liberalizing the mind and giving an ampler outlook upon life. Through literature the student is made a partaker in the intellectual of other times and other people. He becomes familiar with their manners and customs, their ideals and institutions, their mistakes and failures, and with the artistic forms in which the national genius has expressed itself. When he leaves school such knowledge not only enriches his personal life, but makes him more useful, because a more intelligent member of society. It exerts a steadying, sanative influence, for it furnishes him standards based upon

the best performance of the race everywhere. For us Americans, with out large confidence in our ways and destiny, there is special need for the wisdom that comes from familiarity with the life, literature, and history of the great makers of European civilization."

Teachers will find many helpful suggestions in the Report of the Committee of Twelve, published by D. C. Heath and Company, Boston, (The outlines given below are from this report); The teaching of German in secondary schools by Bagster-Collins, (McMillan Co., New Kork); and from the following pamphlets which are furnished free by the University of Alabama: Brownell's French in the Schools of Alabama; and Foster's German in the Schools of Alabama.

German

German. Five periods per week during first and second years.

Aim of the Instruction

At the end of the two years course in German the pupil should be able to read at sight, and to translate, if called upon, by way of proving his ability to read, a passage of very easy dialogue or narrative prose, help being given upon unusual words or constructions; to put into German short English sentences taken from the language of every day life or based upon the text given for translation, and to answer questions upon rudiments of the grammar as defined below.

Work to be Done

During the first year the work should comprise: (1) Careful drill upon punctuation; (2) the memorizing and frequent repetition of easy colloquial sentences; (3) drill upon the rudiments of grammar, that it upon the inflections of the articles, of such nouns as belong to every day life, of adjectives, pronouns, weak verbs, and the more usual strong verbs, also upon

the use of the more common prepositions, the simple uses of the model auxiliaries, and the elementary rules of syntax and word order; (4) abundant easy exercises designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (5) the reading of from 75 to 100 pages of graduated texts from a reader, with constant practice in translating into German easy variations upon sentences selected from the reading lesson (the teacher giving the English), and in the reproduction from memory of sentences previously read.

During the second year the work should comprise: (1) The reading of from 150 to 200 pages of literature in the form of easy stories and plays; (2) accompanying practice, as before, in the translation of German of easy variation upon the matter read, and also in the off-hand reproduction, sometimes orally and sometimes in writing, of the substance of short and easy selected passages; (3) continued drill upon the rudiments of the grammar, directed to the ends of enabling the pupil, first, to use his knowledge with facility in the formation of sentences, and, secondly, to state his knowledge correctly in the technical language of grammar.

French

French,—Five times per week during the Third and Fourth years.

Aim of the Instruction

At the end of two years course the pupil should be able to pronounce French accurately, to read at sight easy French prose, to put into French simple English sentences taken from the language of every day life, or based upon a portion of the French text read, and to answer questions on the rudiments of the grammar as defined below.

The Work to be Done

During the first year the work should comprise: (1) Careful drill in pronunciation; (2) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles and pronouns, the use of personal pronouns, common adverbs, prepositions and conjunctions; the order of words in the sentence, and the elementary rules of syntax; (3) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the natural forms of expression; (4) the reading of from 100 to 175 pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (5) writing French from dictation.

During the second year the work should comprise: (1) The reading of from 250 to 400 pages of easy modern prose in the form of stories, plays, or historical or biographical sketches; (2) constant practice, as in the previous year, in translating into French easy variations upon texts read; (3) frequent abstracts, sometimes oral and sometimes written, of portions of the texts already read; (4) writing French from dictation; (5) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (6) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

DRAWING

By PROFESSOR J. J. DOSTER.

First Year

Geometrical Drawing.—Two periods per week during First year.

The difficulty that most students encounter in beginning plane geometry or in attempting to solve problems in algebra is due to their inability to interpret in a concrete way the abstract statements of the theorem or the problem. The power *to visualize* in them is lacking and needs to be developed. Geometrical drawing, if properly taught, is an effective means of developing this power, and through it the approach to geometry and algebra can be made easy and exceedingly interesting even to the average student.

In teaching geometrical drawing but little equipment is necessary. The teacher should provide himself with a pair of dividers, which can be procured from any firm dealing in school supplies, with which to construct figures on the boards; and he should also have convenient several meter or yard sticks, and a large right-angle triangle, which any carpenter can make of wood. Each student should have a protractor, a small pair of dividers, a right-angle triangle and a short rule, all of which can be had in a wooden case for 40 cents from Ginn & Co., Atlanta.

In teaching this subject great stress should be placed on neatness and accuracy in the construction of figures, and each pupil should be taught to rely upon himself in the solution of the various problems. Occasionally the pupils may be required to solve by the means of lines easy problems in algebra and arithmetic.

Second Year

Mechanical Drawing.—Two periods per week during Second Year.

Linear drawing may be substituted for mechanical drawing in schools where conditions do not warrant the purchasing of equipment for teaching the latter. If linear drawing is offered the text book work should be supplemented by various problems in construction taken from geometry; and in this way preparation can be made for what is usually to the average student a difficult part of plane geometry. The same equipment can be used in this as in geometrical drawing.

Mechanical drawing demands better, and consequently somewhat more expensive, equipment than is necessary for geometrical drawing. Each student must have a drawing board, T-square, 30-60 degree triangle, 45 degree triangle, and a set of drawing instruments. A combination set of drawing board, T-square, and two triangles can be bought for 50 cents from Milton Bradley, Atlanta. Eugene Dietzen Co., New Orleans; Keuffel and Esser, New York; Sears Roebuck and Co., Chicago, are firms which deal in drawing supplies. From them sets of instruments may be had, costing from \$1.50 up.

In schools where mechanical drawing is offered, it is expected that the special teacher will outline the course and adapt the work to meet the needs of the students. It is intended that this course shall be taught in connection with manual training.

For suggestion as to the necessary equipment of a department of manual training and drawing, write to Prof. V. P. McKinley, Department of Manual Arts, State Normal College, Troy, Ala.

*Manual Training

A special syllabus will be prepared for those schools which desire to establish a department of manual training. The syllabus will include an outline of the courses to be offered, a de-

*The short topics on Manual Training, Commercial Geography, Commercial Arithmetic, Book-keeping and Commercial Law were written by Professor J. J. Doster.

tailed statement of the necessary equipment, an estimate of the cost of same, and an estimate of the running expenses of the department.

Home Economics

Home Economics is a subject that is just now making its way into the schools. Its function is primarily to prepare girls for the duties of home-keeping just as the function of manual training is to introduce boys to the industrial side of life. Special teachers will be needed to handle this subject.

*Commercial Geography

Commercial Geography.—Five periods per week during First year.

This subject will be taken instead of a foreign language by students who elect the Commercial Course. Teachers should require class to make a collection of as many raw articles of commerce as possible and arrange these so as to show localities from which they come. This collection might form the nucleus of a school museum.

*Commercial Arithmetic

Commercial Arithmetic.—Five periods per week during second year.

This course is designed to prepare the boy for a place in the office or counting room, and only those who have already mastered the fundamental operations and principles of arithmetic are prepared to take it. Commercial arithmetic is a drill in the processes and principles of arithmetic in order to make the pupil rapid and accurate in this application. Rapidity and accuracy are the ends to be attained, and the teacher should strive diligently until these are secured.

*The short topics on Manual Training, Commercial Geography, Commercial Arithmetic, Book-keeping and Commercial Law were written by Professor J. J. Doster.

It is not intended that commercial arithmetic should take the place of the ordinary arithmetic, but rather it is to supplement the latter by stressing certain processes in which speed and accuracy are called for.

***Bookkeeping and Commercial Law**

Book-keeping.—Five periods per week during the Third and Fourth years.

The course in book-keeping extends over the Third and Fourth years. During the second half of the Fourth year at least two periods each week should be devoted to commercial law.

Teachers are strongly urged to make this work as practical as possible. Some time during the course farm book-keeping should receive attention. It is hardly necessary to say that no teacher, unless he had had some business training, should attempt to teach these subjects.

*The short topics on Manual Training, Commercial Geography, Commercial Arithmetic, Book-keeping and Commercial Law were written by Professor J. J. Doster.

A Suggestive Course of Study for Grades from One to Seven Inclusive

First Grade

The Arnold Primer.
Stepping Stones, First Reader.
Baldwin's First Reader.
Spelling: Words Taken from the Reader.
Drawing Paper.
Nature Study.
Language—Oral Work.
Tablet and pencil.
Number Work. No book required.
Copy Book No. 1.

Second Grade

Stepping Stones, Second Reader.
Baldwin's Second Reader.
Eaton's Speller.
VanAmburgh's First Days in Number.
Nature Study.
Alabama Copy Book No. 2.
Language Work, Oral and Written.
Drawing Nos. 1 and 2.
Tablet and pencil.

Third Grade

Baldwin's Third Reader.
Stepping Stones, Third Reader.
Home Geography, Tarr and McMurry.
Eaton's Speller.

Elementary Arithmetic—Colaw, Duke and Powers.

Arnold's Language Lessons with Pen and Pencil.

Alabama Copy Book No. 3.

History: Stories of great men told by teacher and reproduced by pupils.

Drawing Nos. 3 and 4.

Tablet and pencil.

Fourth Grade

Baldwin's Fourth Reader.

Stepping Stones, Fourth Reader.

Eaton's Speller.

Modern English, Book I.

Frye's First Course in Geography.

Elementary Arithmetic—Colaw, Duke and Powers.

History: Stories of ancient lands told by teacher and reproduced by pupils.

Alabama Copy Book No. 4.

Drawing Nos. 5 and 6.

Fifth Grade

Baldwin's Fifth Reader.

Stepping Stones, Fifth Reader.

Eaton's Speller, completed, and Striplin's Spelling Blanks.

Modern English, Book I. completed.

Krohn's Physiology and Hygiene, Book I.

Practical Arithmetic, Colaw, Duke and Powers.

U. S. History—Makers of American History.

Frye's First Course in Geography, completed.

Brook's Mental Arithmetic.

Alabama Copy Book No. 5.

Drawing No. 7.

Sixth Grade

Baldwin's Sixth Reader.
 Stepping Stones, Sixth Grade.
 Reed's Word Lessons, and Striplin's Spelling Blanks.
 Modern English, Book II.
 Frye's Higher Geography.
 Holding's Real Things in Nature.
 Thompson's U. S. History.
 Practical Arithmetic, Colaw, Duke and Powers.
 Brooks' Mental Arithmetic.
 Alabama Copy Book No. 6.
 Drawing No. 8.

Seventh Grade

Practical Arithmetic, completed.
 Thompson's U. S. History, completed.
 DuBose's History of Alabama.
 Reed's Word Lessons, completed, and Striplin's Spelling Blanks.
 Modern English, Book II., completed.
 Krohn's Physiology, Book II.
 Frye's Higher Geography, completed.
 Agriculture for Southern Schools, Duggar.
 How We Are Governed in Alabama and the Nation, by McBain and Hill.
 Alabama Copy Book No. 7.

This course of study articulates with the course adopted for the county high schools. It is highly important that teachers in common schools adopt this course and follow it faithfully so that provision may be made for admitting students to the high schools without examination after they complete the work in the seven lower grades.

The public schools vary so greatly in length of term it was deemed unwise to indicate any specific amount of work for

completion in a given book during a term. The several grades are provided with work covering not less than eight or nine months.

The books referred to must be used before the selection by the teachers of supplementary books of corresponding kind.

Pupils above the third grade should each provide themselves with a Webster's Dictionary, either the Primary, Common School or Academic.

Singing may be taught by grades, in schools of several teachers, or by assembling all pupils in schools of one or two teachers.

In teaching the subject of writing the adopted copy books must be used in every grade in which writing is taught.

The position assigned to the subject of Alabama History is tentative. The author and publisher insist upon its adaptation to the 5th or 6th grade. The book, at this writing, has not come from the press. Whatever the grading may be for which the book is fitted, the right sequence would seem to be, to have this subject matter preceded immediately by the text on United States History, allowing one and a half years for Thompson's History of the United States, and one-half year for Alabama History.

If the subject of algebra should be attempted in the common schools, teachers must remember that Milne's High School Algebra and Stone-Millis's First Algebra are the adopted text books.

If the subject of English Grammar is pursued beyond the three books placed in the foregoing grades, teachers will note that Reed and Kellogg's Higher Lessons in English is the adopted book.

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